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Photograph, Brown Brothers

FIG. 1. THE MOUNT MORRIS HIGH SCHOOL, IN NEW YORK CITY

An excellent example of a large and well-lighted building. C. B. J. Snyder, architect

HEALTHFUL SCHOOLS

How to Build, Equip, and Maintain Them

BY

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EDITOR'S INTRODUCTION

The subject of school hygiene comprises two general fields. First, the provision of healthful physical environment for school children, and second, the conduct of healthful school activities. Under the first head we have to do with such matters as schoolhouse construction, fire protection, lighting, and sanitation; under the second, we deal with medical inspection and supervision, playground activities, outdoor classes, and the like.

These two main groups have been subdivided into smaller branches, each growing up almost independently of the other, and it is only recently that school men have recognized their essential unity and grouped them all together under the general heading of school hygiene. It is not at all unusual even now to find large and fairly well-organized school systems where the division of physical training has little to do with the division of medical inspection; where the medical inspection is under the control of a city or county board of health; and where the provision of school lunches, open-air classes, classes for exceptional children, fire protection, and the cleaning of school buildings are all matters which concern separate departments within the school system. The appointment of an assistant superintendent of schools in charge of child hygiene and child welfare, who shall have all such matters under his supervision, has only recently been accepted in educational theory, and is still a new and not frequently found feature of school administration.

Because the question of school hygiene has never until recently been thought of as a whole by educators, but has

been split up into a score of apparently unrelated minor problems, its progress has been erratic. Minimum requirements in some cases are laid down by the State, with immense detail; in others the State makes hardly any demands upon the local school authorities, but leaves them free to carry on whatever experiments they will. In general those phases of school hygiene which deal with school buildings and the material welfare have been given large emphasis, while those which deal with child welfare have been neglected. The natural result is that in most school systems important features of school hygiene are largely overlooked or entirely ignored; and that the school superintendent frequently fails to have any clear conception of what is demanded by the situation. The school authorities, both board and superintendent, too frequently fail to grasp the subject as a unified whole.

To treat the subject as a unified whole, and in condensed form, has been the purpose of the authors of this volume in the series. The authors have tried to set forth the essentials, under each subdivision of the subject, which the school administrator needs to know in order to safeguard the health of the children under his care; to show what forms of organization the different branches of the subject involve; and to give a brief statement of the accepted standards in each branch. The volume should prove very useful as a text-book in school hygiene in colleges and normal schools, and should furnish a basis for intelligent discussion and constructive action by teachers, supervisors, superintendents, and school board members.

Ellwood P. Cubberley

CONTENTS

ILLUSTRATIONS

HEALTHFUL SCHOOLS

CHAPTER I

CHOOSING THE SCHOOL SITE

Locating a building. In the small town or rural community the location of the new school building is not infrequently a burning issue. Superintendents have lost their places and school boards have failed of reëlection because of the unpopularity of their decisions. Occasionally this is a desirable result; but far too often the pressure brought to bear upon educational authorities has been due to the interests of local factions, rather than to an appreciation of the needs of school children. Sometimes trouble arises over the distribution of population. Parents on one side of town are unwilling that their children should be obliged to walk a quarter of a mile farther than those at the other side of the district; and a plot of land is chosen as nearly as possible at equal distances from both, and fought for bitterly. Sometimes the school is desired as a show building, and leading citizens demand its location on the main street near the railroad station, police headquarters, and the fire-engine house; or a plot of land near the marshes on the lower part of town can be used for nothing else, and is urged upon the school board because it is for sale cheap.

It is thoroughly desirable that the people of the community should feel this active interest in the erection of their new school building, and it is but natural that they should wish to have a part in the final decision. Yet local people must remember, and school men must forcefully remind

them, when necessary, that the schoolhouse is intended primarily for children; and the location chosen must be, not that which most pleases fathers and mothers, but that which will provide most fully the educational opportunities their children need.

Accessibility. The location chosen should be within reach of all the children; but this does not necessarily mean at the center of the district. No child should have to walk more than a mile and a half to school; and where the building is at a greater distance some means of transportation should be provided at public expense. Where city schools are placed several miles away in the country, as has frequently been suggested, for example, in New York, transportation facilities should be under careful supervision, with special cars and through service, so that parents may feel no anxiety concerning the children's safety. Parents are inclined to object strongly to any arrangement which takes their children more than a few blocks away from home. Attempts to do so must be tactfully and gradually introduced.

In some of the more sparsely settled States, school buildings have been erected on plain or mountain-side without reference to any public highway. Naturally teacher and pupils could only reach the spot with difficulty, and it is now not uncommon to find legal provision made against such isolation.

The school census and building plans. It is important in choosing new sites for school buildings to keep in mind the chances of a growing and shifting population. In the Cleveland Education Survey Report on Buildings and Equipment we find: —

> The change in location of the Otis Steel Company's plant to the southwestern part of the city has resulted in a sudden overflow of pupils in the Tremont School. Hundreds of families are moving

into the vicinity of the new works, and demanding school accommodation for their children. Temporary quarters have been arranged in basement or "ground-floor" rooms and portables; but now the Board is facing the necessity of erecting an annex to Tremont and will probably soon need to build a new building in the near vicinity. The Harmon School, which has until now been seriously overcrowded, is just on the boundary line of what will shortly be an immense freight yard. Over one thousand families have been forced to leave their homes in order to make room for the new tracks. Their children are no longer in the Harmon District; but where they are going no one yet knows. They may scatter over the city or migrate in a body. The Board is anxiously concerned as to their destination; for it may seriously affect the school-building policy.

Besides such sudden changes from one part of the city to another, there is the more steady growth and shifting which takes place year by year, and which must be taken into account in mapping out the school-building policy. The school census, which is required by law in many places, and which is a regular feature of school administration in most progressive communities, furnishes excellent means for judging changes and trends in population. The Cleveland Report continues: —

By comparing results from year to year future growth can be predicted and new buildings planned accordingly, while smaller unexpected shifts can be handled through emergency measures during the summer vacation immediately following the census returns. The school census should be one basis for shaping the future building policy of the Board.

Relation to public highways. The schoolhouse should be near the public highway, but not too near. A hundred years ago it was the common thing for buildings to be erected on the road itself, not infrequently placed in the center of the crossroads, so that vehicles passed on all four sides, and the highway served as the only playground. To-day we try to secure sites large enough so that the building may be placed

at some distance back from the street, or, when this is not possible, we plan to have all classrooms face away from the street and thus escape part of the noise and dust of travel. It is rarely wise to place a school building directly on the main thoroughfare, because such a location is apt to bring with it, either at the time of building or in the near future, the noise of cars and other vehicles, shouts of newsboys and peddlers, clanging of police, ambulance, and fire-engine gongs, and other disturbances which render teaching and learning difficult. Moreover, property values on such a street are apt to be so high that the schools feel extra grounds an extravagance, and little space is secured for playgrounds, athletic fields, or gardens. Tall buildings crowd in on every side, and there is difficulty in securing proper lighting. Instead of following the rule that "Each child at his seat must see the sky," we often furnish the pupil with an uninspiring view of brick walls and iron fire escapes.

In cities and towns the school building should be placed on a quiet side street, away from dangerous crossings and car tracks. Where it is necessary for all or most of the pupils to cross the car tracks, it is probably wise to place the school near enough to the crossing so that the teachers may exercise supervision. In the larger cities such supervision is taken in charge by the police force; but in many of the smaller places crossings are unprotected and furnish a real danger. A zone of quiet should be established around every school building.

Removed from disturbing influences. In both urban and rural districts care should be taken to select a school site which is at a distance from annoying or improper influences. Many States have by legislative act established zones around each schoolhouse within which certain activities are prohibited. For example, in Iowa no bills, posters, or other matter advertising liquor or tobacco may be distributed,

posted, or circulated within four hundred feet of premises used for school purposes. Many States provide similar zones in which liquor cannot be sold. A regulation of the Delaware State Board of Health forbids the placing of any stable, pigpen, or other building liable to become a nuisance within two hundred feet of any schoolhouse, or within one hundred feet of the school yard. The Indiana law says there must be no steam railroads, livery stables, barns used for breeding purposes, noisy industries, or unhealthful conditions within five hundred feet of schools, and the State Board of Health has defined these "unhealthful conditions" by demanding that a zone of five hundred feet radius about the school site be free from swampy ground, body of stagnant water, cemetery, slaughterhouse, fertilizer-reduction plant, or any business or manufacturing establishment which engenders noxious odors or vapors or that pollutes the surrounding atmosphere by smoke or dust.

Size of plot. The site must not only be well located with reference to accessibility, freedom from noise, odors, and the like, but it must also be large enough to make possible newer methods in education. In the old days, when all learning was book learning, and pupils were expected to sit still during the entire school period, there was comparatively little need for large school grounds. Even to-day, if the teacher is willing to confine his activities to this narrow and less fatiguing conception of education, he need concern himself little with playgrounds and gardens. But public opinion is gradually changing, and the thoroughly up-to-date community is scarcely willing to submit its children to the outworn methods of a hundred years ago. Modern schooling takes place outdoors as well as in; and large grounds are necessary if children are to be properly cared for.

That this is a new conception in education may be

gathered from reading the various State laws, many of which must inevitably be changed in the near future. For example, William A. Cook, of the University of Colorado, in his study of laws and regulations governing the hygiene and sanitation of schoolhouses, published by the United States Bureau of Education in 1915, gives as the absolute maxima for the size of school sites in certain States, "Delaware, one half acre; Kentucky and New Hampshire, one acre; Kansas, one and a half acres; Massachusetts and South Dakota, two acres (although in South Dakota schools giving courses in agriculture may purchase ten acres for site and demonstration purposes); Maine, three acres; Maryland and North Dakota, five acres."

While the actual number of square feet in each school site must of necessity vary, the grounds selected should be large enough to allow for the erection of low buildings — not more than two stories high — with an auditorium and other special rooms. In addition there should be plenty of playground space. The common recommendation of fifty square feet per child allows him only about two and a half times as much space as he is allotted in the average forty-pupil classroom. Such an arrangement is well fitted to quiet games of marbles, mumble-peg, or jackstones; but if children are to join in active sports with running and jumping they must be provided with at least two hundred square feet of playground space for every pupil enrolled.

In addition to the regular playground space there should be some provision for special games, such as handball, volley-ball, tennis, or basket-ball. Each country school should be provided with a good baseball field, and all of the larger schools should have running-tracks. Where land is cheap, space for an outdoor theater is a good investment. The school grounds should also include ample space for individual or group gardening. The rural school should

never occupy less than three acres of land; the city school should be provided with from three to ten acres, depending upon the number of children cared for. It is unfortunate that many of our city schools are located where land is so expensive that little more than enough ground to support the building can be purchased.

Lighting. The school board must look, then, for a plot of ground of several acres, easily accessible, and protected from noise and nuisances. In addition, the location must be such that plenty of sunlight is available throughout the year. In mountainous districts the horizon line is often high, so that schools built in the valley or on the side hill are during a large part of the day in shadow. Sometimes suggested sites are too close to thick groves of trees, or in city districts tall buildings cut off much of the light. There are various rules for deciding upon the location of buildings with respect to light. One is that every child should be able, sitting at his seat, to see the sky. Another is that no tree or building should be nearer to the school windows than twice its own height. Where obstructions occur on one side of the location only, the difficulty may frequently be met by placing the windows of the classrooms on the opposite side of the building.

High ground. In rural districts it is frequently necessary to provide protection against strong winds and storms. The State Board of Health of Vermont refuses to approve a site for a rural school unless it is so protected. The common practice of locating the school building at the summit of the highest hill in town is strongly to be condemned on this and several other counts. Not only is a building so situated exposed to all the rigors of the climate (which frequently render heating problems serious), but the location demands unnecessary exertion on the part of teachers and pupils in reaching the school, and effectually prevents many parents

from ever visiting it. Moreover, such a site is poorly adapted to playground use, because there are very few games which can be played on a slanting surface; and school gardens so located are apt to be of poor soil, and easily washed away by violent rains. It is well to build the schoolhouse on land higher than that around it, but this should not mean at the top of a hill.

Soil. One of the most important points to be considered in the selection of a site for the new school building is the character of the soil. Swampy land, clay, or made ground are all to be avoided, because of the danger of ground air and ground damp. Probably a sandy loam is the most desirable soil for building purposes. For many feet below the surface the earth is honeycombed with little crannies and interstices, each filled with air which flows from one to the next. During a long summer's day the earth, together with the earth-bound air, becomes warmed. At the end of the day, when the sun goes down, the upper air becomes chilled and heavy; it sinks down into the ground and forces out the lighter warmed air which has been hidden below the surface. This ground air, as it is commonly called, is heavily laden with impurities. Bits of vegetable and animal matter, as they decompose, give off gases which are carried to the outer air. Ground air is heavily charged with moisture. It is rich in carbon dioxide, and frequently contains marsh gas, hydrogen sulphide, and ammonia.

When at night the chilled air presses down upon the earth's surface, the ground air seeks the easiest means of escape. The soil directly beneath the building is apt to be dry and warm, and since the pressure of air in the cellar is slight, the natural result is that the ground air rushes up from the earth through the cellar, as though drawn through a huge chimney. In sandy soils it is easy for the air to escape directly to the surface, and a gradual shifting takes place all

day long, but where the surface is hard-baked clay or frozen ground, the danger of ground air escaping by way of the cellar is very great. The sweating so commonly noticed on cellar walls and the musty cellar odor are sure signs of the presence of ground air. When ground water rises too near the surface and is not quickly evaporated by the sun's rays, — where, that is, the soil is impervious and forms a thick crust through which air and water move but slowly, — the under soil is kept damp and decomposition of organic matter is greatly accelerated. As a result, escaping ground air is heavily laden with impurities. In choosing a school site, therefore, we must avoid low, marshy land where there is likely to be a constant supply of moisture below the surface, or clay soil which forms a hard crust and prevents thorough ventilation of the earth.

We must also — and this is especially true in the case of town and city schools — avoid erecting buildings on made ground, because, where lots have been filled in by using them as dumping grounds, there is usually an excess of organic and corrupting materials. Where possible, if such a site must be used, the contaminating material should be scraped up and carted away. To cover up such refuse by sandy loam is of little value. In certain regions, such as the Fenway of Boston, for example, where the salt marshes of twenty years ago have been converted into solid ground and are now being utilized as sites for a remarkable gathering of educational institutions, such a carting away is entirely out of the question; and the only remedy is to abandon the site or else protect the buildings so far as may be by the most carefully built drains and foundations.

In rural schools it is especially important, in addition to the foregoing considerations, to select a location where the surrounding land may be successfully cultivated. The teacher who seeks to conduct classes in agriculture cannot

hope to gain the coöperation of near-by farmers unless the school gardens are worth working over.

Improving sites of old buildings. Old schools badly located may often be improved by a few simple measures. Bleak, windy hilltops may sometimes be rendered more comfortable by building a surrounding wall, or planting sturdy evergreen trees so as to form a windbreak.

Busses may be hired to carry children to and from school to outlying homes.

In cities, zones of quiet may be established through coöperation with the police department, and sometimes a cobbled street may be repaved with asphalt or creosote blocks.

Where the school grounds are inadequate, adjacent plots may sometimes be bought or hired; and school gardens have been successfully operated at some distance from the building. Not infrequently a vacant lot will be temporarily donated for school purposes.

The lighting problem is less easily handled. Where obstructions are on one side only, it is sometimes possible to increase the number of windows on the opposite side, and one-story schools are frequently provided with skylights. Prism glass is frequently recommended. Artificial lighting during regular school hours is not desirable, and where the natural illumination remains insufficient the building should be abandoned for school purposes.

Where an old school shows the effects of ground damp and ground air, it is sometimes possible to carry away the ground water by means of drains outside the building and thus somewhat retard the process of organic decomposition. Occasionally the outer part of the foundation walls may be rendered impervious to water by coating with hot tar below the earth line. Swamps may sometimes be drained, and stagnant pools given an outlet without exorbitant expense.

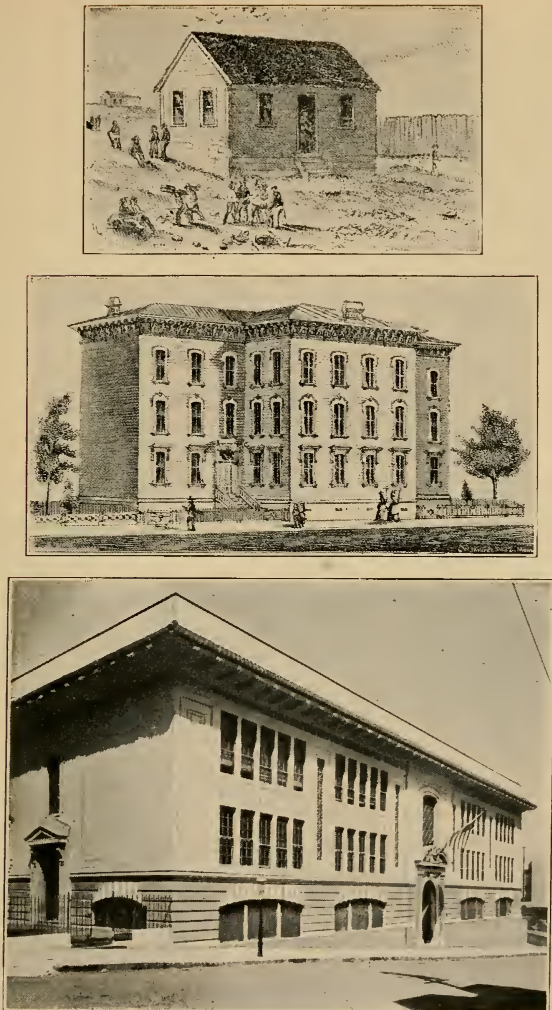

FIG. 2. THREE GENERATIONS OF SCHOOL BUILDINGS
SAN FRANCISCO, CALIFORNIA

(*a*) The first schoolhouse in the city. Erected on the plaza in 1847

(*b*) Type of grammar-school buildings of the seventies. Wood; capacity, one thousand pupils; cost, $30,000

(*c*) The Sarah B. Cooper School. Built in 1914–15, at a cost of $103,112

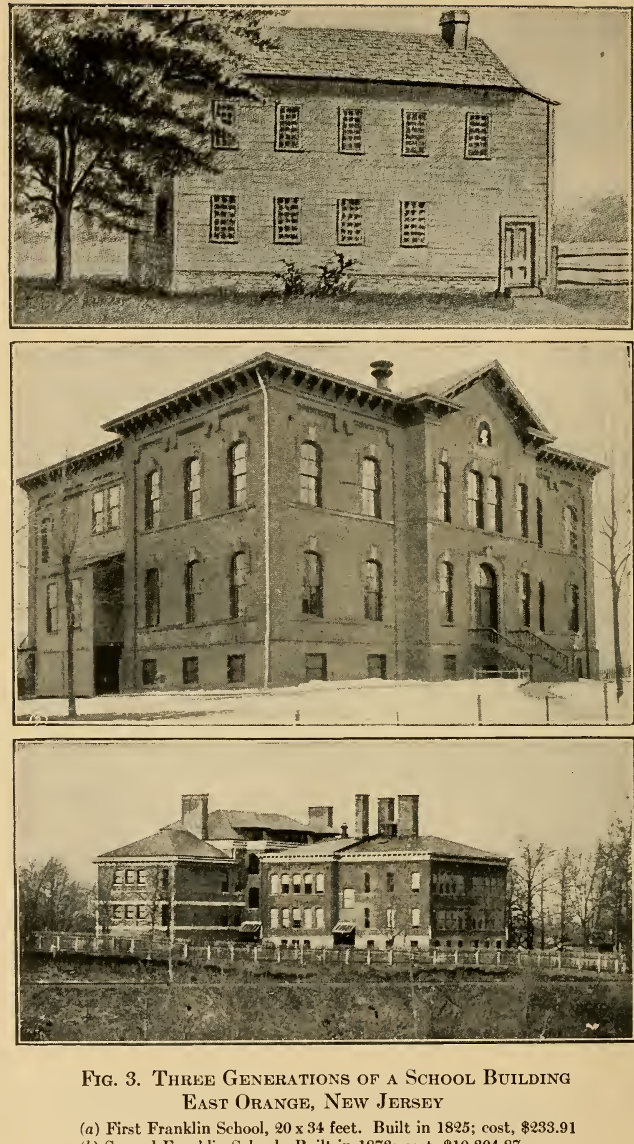

FIG. 3. THREE GENERATIONS OF A SCHOOL BUILDING
EAST ORANGE, NEW JERSEY

(*a*) First Franklin School, 20 x 34 feet. Built in 1825; cost, $233.91
(*b*) Second Franklin School. Built in 1873; cost, $10,304.87
(*c*) Third Franklin School. Built in 1886–1914; cost, $107,442

To summarize: In deciding what constitutes a satisfactory school site, we shall often find it helpful to think of plots of land as being of equal value in every other particular, and then weighing the one against the other with reference to the point in question. For example, other things being equal, that site is preferable which is more centrally located. So we may also say: Other things being equal, that site is preferable which —

is more likely to fit future needs;
is more accessible to the public highway;
is located on the more quiet street;
is more free from noise;
is more free from dust;
is more free from unpleasant odors;
is more free from immoral or disturbing influences;
is less likely to be hemmed in by surrounding buildings;
is more remote from dangerous street or railroad crossings;
has the larger area;
receives more sunlight;
is more protected from winds;
is on higher ground;
is not on hilltop or hillside;
has the more permeable soil;
has less decaying organic matter in the soil;
has the dryer soil;
is more easily cultivated.

QUESTIONS FOR STUDY AND DISCUSSION

1. Outline in detail a method for using census figures to guide building policy.
2. Make a survey of the school buildings of your town. Suppose they all were to be rebuilt, what would be the best sites for them? Why? How could their present sites be improved?
3. Who should be consulted in selecting the school site?
4. Suppose that only one site is available. What treatment should be given the soil if it is of clay? Of sand? Swampy?

5. How can the school board know what kind of soil underlies a proposed site?
6. Make a plan showing the site of an eight-room elementary school building. Indicate points of the compass, size and shape of plot, location of building, location and number of trees, gardens, playgrounds, and other desirable features.
7. Suppose that a side hill is the only site available, what is the desirable treatment?

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List of questions to be answered by student of education on school site.

CHAPTER II

THE SCHOOL BUILDING

The architect. The most important part of a school building is the planning which precedes it. During the early part of the century drawing up specifications for a new schoolhouse frequently fell to the lot of the school board, the teacher, the local carpenter, or persons who spoke of themselves as "amateurs in architecture." To-day there are firms and individual architects who have gained national reputations in the field, and who devote all of their time to school planning. School boards in many of the larger cities employ one or more architects, on a full-time basis, because they have found that expert service is in the long run a wise investment. No matter whether the community in question be city, town, or country, the services of an architect with long experience in school work should be utilized before building operations are undertaken.

In cities, where school buildings are necessarily large and complicated, it is best either to secure the permanent services of a well-qualified architect who will devote all his time to local problems, or to put the matter into the hands of one of several architectural firms which have made schoolhouse planning their specialty. Smaller towns will do well either to consult one of these firms, or to secure plans of buildings already erected under the direction of well-qualified architects. The local architect, no matter how clever, should not be hired to superintend the erection of the new school building until he has given positive evidence of understanding this highly specialized branch of his subject.

Town and rural communities should take advantage of the assistance offered by many State departments of education and by the Federal Bureau of Education at Washington. Plans for rural and consolidated schools have been drawn by some of the most skillful architects in the United States, and may be secured either entirely free or for a small sum. The Bureau also gladly furnishes criticism and suggestion on proposed plans. Such works as F. B. Dresslar's *American Schoolhouses* and *Rural Schoolhouses and Grounds*, both published as bulletins by the United States Bureau of Education, contain plans and suggestions which not only give help to boards planning to build, but also serve as textbooks for boards and teachers who are seeking to learn more about the problems involved in schoolhouse construction. The *American School Board Journal* has a special division for new buildings, and the educational authorities of several States have prepared bulletins showing plans and specifications. No matter how poor a community may be, it has no excuse for building a badly planned schoolhouse.

The plan. The plan chosen should provide for a building, beautiful in outline, simple to construct, adequate for educational purposes, and, in regions where the population is steadily increasing, so designed that new portions can be added without impairing the utility or beauty of the old. The American public is slowly being convinced that towers, wooden scroll-work, pointed windows, and diamond panes are not only ugly, but evidences of poor taste as well. Architectural atrocities are still to be found newly risen on every hand, but their number is decreasing, and reputable firms no longer bear the responsibility for them. It is curiously true that beauty of outline and economy of money outlay are in positive correlation. Given the same quality of material and workmanship, the same equipment of rooms and windows, and it will be found that the building with plain

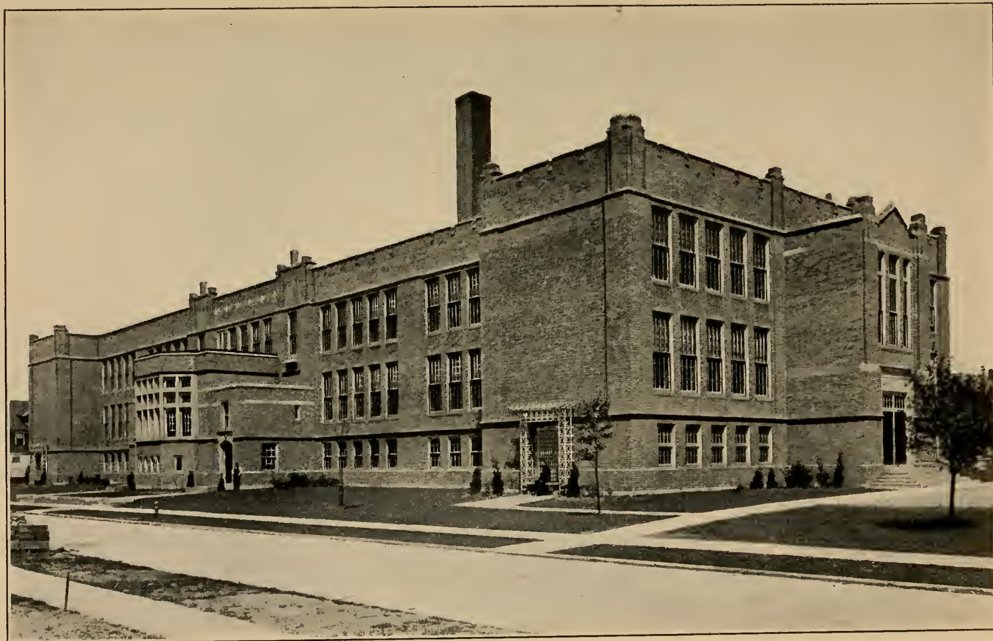

Fig. 4. The New Empire School, at Cleveland

An excellent example of a modern elementary school. Built on the unit plan (see p. 17), like a sectional bookcase

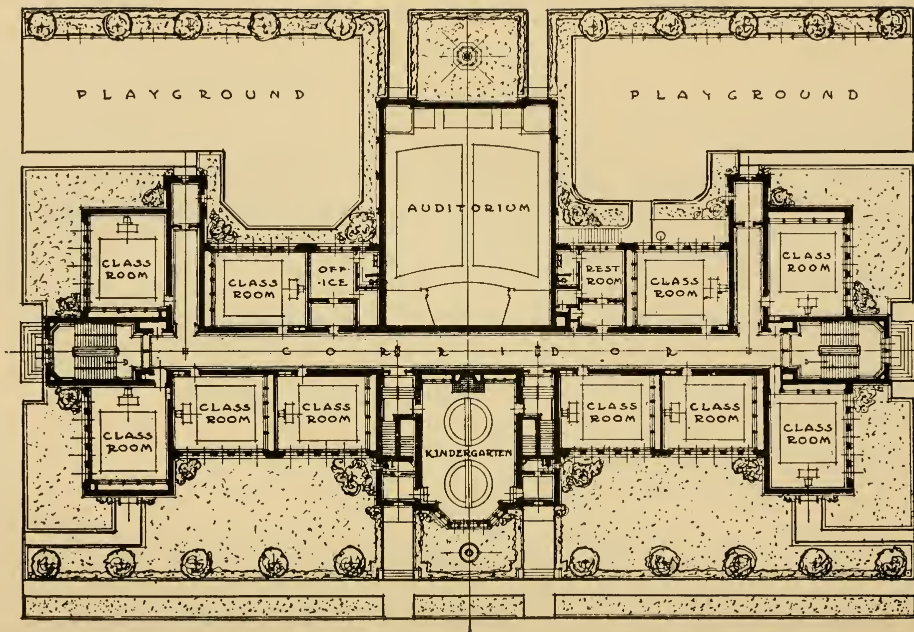

FIG. 5. FIRST-FLOOR PLAN FOR THE EMPIRE SCHOOL, CLEVELAND

lines will actually cost less in dollars and cents than its more pretentious and less artistic rival.

Before the actual lay-out of rooms can be made, it is necessary to decide in general what sort of a building is to be erected. Is it to be one unit in a building group arranged on the cottage plan, or one large building complete in itself? Is it to be several stories in height, or shall the new plan be adopted of one-story buildings lighted from above? Is the building to be of non-fireproof, semi-fireproof, or entirely fireproof construction? Shall the outer walls be of wood, brick, stone, or concrete? The answer to all these questions will necessarily depend upon where the building is to be located, the amount of money available for building purposes, and the especial use to which the building is to be put.

Before the plans can be subjected to intelligent criticism, it is necessary that the school authorities shall have made a careful study of the general problems of school hygiene. Before the building committee can properly act upon recommendations for or against the finished plan, its members must be familiar with the modern standards of lighting, heating, ventilating, sanitation, fire protection, arrangement of classrooms, and the like. They should study the educational magazines in order to see what buildings are being erected in other places, and should visit personally some of the newest and most interesting buildings in the hope of getting suggestions for their own. Since the architecture of schoolhouses is one of the most rapidly changing fields, it is important that superintendent and school board members make special efforts to keep abreast of the times. When one realizes that flat-roofed buildings with isolated stairways, unilateral lighting, and first-floor auditoriums were being constructed by leading architects twenty years ago, one feels a distinct shock to discover that at the present time there are in the process of erection hundreds of school

buildings of the old box-like type in which many of us were housed when we were children.

In communities where the population is growing, it is essential to see to it that the plan of the new schoolhouse allows for the building of future extensions. One of the principal reasons why the old-type square school buildings have given way to the newer L, T, H, and U buildings is, that with the former types an added wing usually cut off light from classrooms in the older part. Modern buildings are planned in such a way that one or two new wings may be added without interfering with either the utility or external appearance of the building.

Plans should be studied also from the point of view of "wider use" or community service. The "socialized schoolhouse," as it is frequently called, is so arranged that its auditorium, library, toilets, and gymnasiums can be cut off from the rest of the building and opened to the public without allowing access to classrooms or offices.

Apportionment of space. An exceedingly interesting piece of work is now being carried on by the "Committee on Standardization of Schoolhouse Design and Construction of the Department of School Administration of the National Education Association." Frank Irving Cooper, of Boston, one of the leading school architects in the United States, is chairman of this committee, and the other four members are all men who have become prominent in the fields of school architecture, hygiene, and administration. The committee is making a careful study of plans for modern school buildings, and aims eventually to publish a report, first, to show what are the standards generally accepted for schoolhouse construction, and second, to determine what plans for school buildings should include and what relative proportion of the total cubic contents and floor areas should be set aside for each specified use. That is, the committee hopes to be able

to furnish suggestions whereby people who are not trained architects may be able to judge the efficiency and economy of space utilization in plans submitted to them.

In its preliminary bulletin the committee points out the amazing differences in cost between buildings in different cities which apparently are planned to accommodate the same number of children, to furnish the same type of facilities, and to be erected of the same materials. It also points out that there is at present no general agreement concerning the number and sizes of rooms required in elementary or high-school buildings. Plans differ widely even where practically the same school programs are being carried on. Through careful study and analysis the committee hopes to be able, in the near future, to present standards based on the best present existing practice.

Unit plans. The question of the correct apportionment of space has within the past several years led to the drawing-up of many different schemes for showing what rooms should be included in school buildings, and relatively how much space should be given to each. For example, the Department of Buildings of the city school system of Pittsburgh, Pennsylvania, publishes a very interesting booklet entitled *Program and Details of Construction and Equipment for Grade Schools*, for the instruction of architects who wish to submit plans. The regular classroom is taken as the unit of space. The booklet lists all the rooms which must be included in the school, together with certain other rooms which, while not essential, are desired. The list is shown on page 18.

An exceedingly interesting development of the unit plan is that designed by Mr. W. R. McCornack, architect for the Cleveland school system. Mr. McCornack uses the classroom as his unit, and plans his building much on the idea of the sectional bookcase or filing cabinet. Across one

	16 classrooms	16 units
	1 ungraded room	$\frac{1}{2}$ unit
	1 kindergarten room 1 kindergarten wardrobe 1 kindergarten toilet 1 kindergarten workroom	$1\frac{1}{4}$ units
Household economy	1 sewing-room 1 wardrobe and locker-room 1 fitting-room 1 model bedroom (desired)	$1\frac{1}{4}$ units
Household economy	1 demonstration room	$\frac{1}{2}$ unit
Household economy	1 domestic-science room 1 wardrobe and locker-room 1 pantry 1 model dining-room (desired)	$1\frac{1}{4}$ units
Industrial training	1 bench-room 1 wardrobe and locker-room 1 storage-room	$1\frac{1}{2}$ units
Industrial training	1 demonstration-room	$\frac{1}{2}$ unit
Industrial training	1 drafting-room 1 wardrobe and locker-room 1 storage-room	1 unit
	2 voting-rooms	1 unit
	1 general office 1 private office 1 book storeroom 1 physician's room 1 teachers' room 1 janitor's supply-room	2 units

1 assembly-room (desired) — 700 seating capacity

2 paved play-yards, each 11,000 square feet

1 girls' play-room 1 boys' play-room	Which it is desired should have areas each equal to two classrooms or greater areas if available

end of the classroom is the wardrobe, with accommodations for eighty pupils, so that the room may be used by two alternating platoons, should the double platoon plan of organization be adopted. By removing the wardrobe partition the room becomes standard size for manual training, cooking, or other similar classes. Two such rooms, with the second divided in half, furnish a kindergarten and kindergarten workroom. Four rooms in sets of two each may be turned into small gymnasiums for separate classes of boys and girls. Four rooms together are equal in size to an auditorium.

In a building constructed in this way all supports are above one another running straight from foundation to roof. Pipes for plumbing and vacuum cleaning are carried in vertical lines, practically without a bend. Materials may be purchased in standard lengths, and in lots large enough to supply several buildings at once. Alterations to allow for administrative changes can be made with ease and rapidity. The unit plan, as Mr. McCornack has worked it out, promises to reduce building costs and provide a much more satisfactory type of building than most of those now in use.

Height of building. Ideally the school building should never be more than two stories high. Actually, in a few of the larger cities, land is so expensive that large areas cannot be secured for school purposes. In such cases the tall building, equipped with elevators, with its playgrounds on the roof, seems to be an unfortunate necessity. Probably even in such cities the time will come when public schools will be built in the suburbs, with plenty of open spaces, and children will be transported to and from the city at public expense. Such a plan is sure to meet with opposition from parents and teachers at first, but, as in the case of open-air schools, medical inspection, and the like, such opposition

will gradually break down as the plan is tried and proves to be of value.

In cities where land values are not exorbitant, nothing over two stories should be erected. Tall buildings mean excessive climbing of stairs for children and teachers. Where the toilets are located in the basement such climbing becomes an additional burden. In addition, unless the school is completely fireproof, the hazard of fire and panic is considerably more than doubled for every additional story. If a building is absolutely fireproof, — which means steel and concrete construction, metal doors, window-sills, and trim, non-inflammable floor coverings, and metal furniture, — and is supplied with thoroughly adequate and efficient elevator service, it may properly be as high as the ordinary office building; but there are very few schools in the country which even approach this standard.

Orientation. The building should be placed on the land in such a way that all its classrooms will receive light either from the east or the west. North light is not desirable because, although it is easy and pleasant to work by, windows facing in that direction never receive direct sunlight. It has been shown by recent experiments that contagious diseases are not spread by germs flying like small insects through the air, but by direct carriers — flies, mosquitoes, food, drink, particles of clothing, or mucus. Colds seem to be spread among groups of people through minute drops of mucus which are sprayed into the air when the sufferer coughs or sneezes. If such contagion is to be avoided the safest preventive measure is to flood with sunshine every corner of the rooms where people gather, and so render these drops of mucus sterile. Every classroom should be flooded with sunshine once every day.

South rooms, on the other hand, are undesirable because they are apt to receive direct sunlight all day long, which

makes rooms uncomfortably hot in summer and renders the lighting problem difficult. Rooms facing east receive the morning sun, but are relieved of its direct rays in the afternoon. Rooms facing west receive indirect light in the morning and direct light in the afternoon. Either east or west lighting is excellent for schoolrooms, although perhaps the east is slightly preferable. Many architects recommend placing the school building so that its sides face halfway between the points of the compass.

Foundations. From the point of view of school hygiene, few things are more important than the method of building the foundation for a school building. An insufficient or improperly built foundation is apt, through capillary attraction, to produce unhygienic conditions in the schoolroom. Ground damp creeps through the walls and introduces cold, clammy air and the peculiar odor so often connected with the cellar of the country farmhouse. Blackboards sweat and buckle, plaster falls, floors and wooden supports rot and gradually fall apart. Dr. Dresslar, in his *American Schoolhouses*, tells of a brick building built on ground where the ground water line was kept at about six feet from the surface by the irrigation of the surrounding country. The foundation walls were constructed of unglazed brick, and no damp proofing had been used. In six years, he says, and almost before the danger was discovered, the timbers supporting the floors had so decayed that the whole of the lower floor was ready to drop into the basement. The building was condemned, and had to be reconstructed at large expense.

Dresslar recommends concrete foundations, with wide footings. The outside of the foundation wall below the surface should be coated with boiling tar or asphaltum before the excavation is filled. A short distance above the surface there should be embedded in the walls a layer of hard asphaltum or a thin layer of slate set in rich fine cement

mortar. Even a layer of tarred paper on top of the wall will be of service for several years. Perhaps the best method of damp-proofing foundations is to insert within the wall a thin layer of 1 to 1 cement.

A very effective, although considerably more expensive, method of protecting against ground water and ground damp is to build a four-inch wall of brick all around, with a one-inch space between it and the main foundation wall, and then to fill the intervening space with a one-inch vertical layer of tar. A one-inch layer of tar, covered with tar paper, is frequently placed beneath the concrete step and underneath the basement floor. While a simple outer coating of tar with a damp-proof layer within the wall above the grade line will usually be sufficient for dry locations, the more elaborate method just described should be employed wherever the ground is wet.

Unless the schoolhouse has been located on the top of a hill, with land sloping away in all directions, — and this is rarely a wise location, — it is essential that a ground drain be built five or six feet outside the foundation walls and below the level of the foundation base. This drain should be constructed of large earthen tiles, well burned, such as are commonly used for draining land. Joints should be left slightly open at the under side, and covered for some inches with coarse gravel or broken stone in order to prevent loose earth from entering and clogging the drain. The drain may either come to the surface at a point well away from the building, where the water cannot flow back, or end in a trap.

Such a ground drain is simple in construction, so that it can be laid by the ordinary workman. It costs very little, and will frequently prevent serious trouble later.

All buildings should be supplied with strong, durable eaves gutters and drain pipes from the roof, to prevent

water dripping off the eaves from soaking into the ground or drenching the upper part of the foundation walls. Such pipes should be large and numerous enough to care for all the roof drainage. Care should be taken to prevent clogging at the top by leaves or twigs. The down pipes should empty into the earthen drains outside the foundation walls through cemented sewer tile, and the water be carried off along with the ground water.

Old buildings with improperly constructed foundations offer a peculiarly difficult problem. In some cases it is possible to expose the foundation wall below the grade line, coat it with tar or asphaltum, and build a drain below the foundation level. Extra coating of cement on the inside is usually of some slight value. Frequently, however, a poorly constructed foundation cannot be remedied, and the building must either be used in spite of dangerously unhygienic conditions or else be abandoned.

Basements. It is desirable that all schools be constructed with basements. This is the common practice in cities, but rural districts have usually felt that a cellar or basement was an unnecessary added expense. As a matter of fact, if foundations have been laid of such a nature that the building is properly protected from ground damp, the added expense of excavating cellar space and laying a floor of asphaltum or cement, based on tar, is inconsiderable when compared with the increased usefulness of the building so equipped. Basements are the best places for heating and ventilating plants. In spite of certain State laws which assume the contrary, heat can be carried to classrooms more economically from the basement than from points outside the building, and if proper precautions are taken the fire hazard is removed. In rural districts a furnace in the basement furnishes more satisfactory heat than a jacketed stove within the schoolroom; and basement space may well be used for an

acetylene lighting plant, small gasoline pump, and other equipment.

A basement provides the best place for indoor playrooms, lavatories, shower baths, etc. It gives ample space for the necessary plumbing, and yet makes these facilities easily accessible to the pupils within the building. Special rooms for manual training, domestic science, etc., can frequently be located in the basement, and for rural schools this is often the cheapest way satisfactorily to provide such equipment.

It is generally the custom to place the main toilet-rooms in the basement, together with smaller rooms on each floor. From the hygienic point of view this is a desirable custom, because, if care is used in planning the basement and installing the apparatus, it is possible to provide for thorough sanitation by connection with the heating and ventilating plant.

Basements should be at least ten feet high, with seven feet above the grade line. If the ceilings are any lower there will be a tendency to use air ducts which are too small and to bend them at acute angles. This will result in continued trouble with the heating and ventilating plant.

A frequent error in planning basements is to provide too few windows. Consequently toilet-rooms, corridors, baths, etc., are poorly lighted; and unhygienic conditions are frequently established which are difficult to remedy. Every effort should be made to flood basement rooms with abundant sunshine. Where there are sufficient funds it is well to line the walls with glazed brick or tile, in light colors. This surface will not take pencil marks easily, is quickly cleaned, and reflects light.

In old buildings it is frequently possible to add one or more windows in the basement wall without excessive cost. The floor of the basement may sometimes be lowered, but, as in

the older buildings basements are frequently already too far below the grade line, deepening them still further is rarely advisable. Damp floors may frequently be rendered impervious to water by adding a thin layer of asphaltum. Solid walls may sometimes be replaced by piers supporting heavy iron cross-beams, or by arches made of brick or concrete, and more space and light may be thus provided. Occasionally better lighting may be secured by digging back the earth for three or four feet outside the foundation wall, and deepening the windows. Painting or whitewashing the inner walls will help in utilizing all the light which is allowed to enter. When structural changes are made the work should be under the direction of an experienced person, and care should be taken not to weaken the supports of the superstructure.

Roofs. The flat roof is rapidly coming into favor, and has shown itself of such value that for all larger buildings, at least, it should be adopted unless excellent reasons can be furnished in favor of the older pitched roof. The pitched roof seems to have originated because of the necessity for getting rid of huge masses of snow, which otherwise would have caused the roof timbers to give way. Under present methods of construction, however, there are very few places in the United States where a flat roof would not be strong enough to bear the weight of snow likely to fall upon it. Pitched roofs are expensive to build. Attics are usually of little use except as storerooms, and their large, unbroken spaces are a constant fire menace. The flat roof can be built more economically, it wastes less space, can often be utilized as an outdoor playground or gymnasium, and is attractive in appearance. The argument that pitched roofs are necessary in order to protect the rooms below from excessive heat is overcome by a study of the architecture in tropical countries, where pitched roofs are practically unknown. From

the point of view of school hygiene the flat roof has much to recommend it.

Floors and floor coverings. All floors should be fireproof, soundproof, and impervious to draughts. Wooden floors should be double, the lower layer being made of rough boards, rather narrow, well seasoned, and set together as closely as may be. They should be laid diagonally upon the floor joists, and covered with a thick layer of deadening material. The ground floor should not only deaden sound, but also exclude damp air rising from the basement. Tarred paper keeps out cellar air, but easily catches fire. Asbestos board, building felt, and mineral wool are all slow to burn, impermeable, and good sound-deadeners. In buildings of fireproof construction a layer of cement below the floor surface effectively deadens sound.

For wooden floors a second layer of boards is laid above the thick layer of deadening material. The best material for the upper boards is oak, maple probably ranks next, and hard pine ranks third in desirability. Soft pine should never be used because it is soft, highly inflammable, splinters readily, catches and holds dirt, and wears out very rapidly. Surface boards should be not more than two and a half inches wide, straight grain, free from pitch, knot-holes, or other defects, and well grooved so that they fit closely together. Care should be taken that not a board is used which shows a defect, because once laid it is sure to cause trouble by slivering, holding dirt, cracking or drawing apart from its fellows, staining, and the like. Careless work in laying floors is frequently responsible for unhygienic conditions later. Blind nailing is usually recommended, but ordinary nailing will prove satisfactory if carefully done. After floors are laid they should be smoothed to an even surface, the pores of the wood should be filled with hot linseed oil well rubbed in, and after thorough drying the whole surface

should be waxed. Floors laid in this manner will last for years, and are easily cleaned.

There are many prepared floor coverings which are now being subjected to experiment, such as cork, sawdust, rubber, fiber, and other materials in varied combinations. One of the most satisfactory floor coverings for rooms, such as kindergartens, special rooms, or classrooms, where movable furniture is used, is a good quality of battleship linoleum, carefully laid and treated with a good preservative. This is rather expensive, but when properly prepared furnishes a smooth surface, pleasant in color, and easily cleaned. It is soundproof, and a poor conductor of heat. Where children are allowed to work seated on the floor linoleum is an excellent covering.

The floors of corridors and basements should be of some material which can readily be cleaned. Well-laid wooden floors carefully oiled are attractive in appearance, but unless the oil is thin and well rubbed in they quickly show footmarks and require constant cleaning. Wooden floors which are cleaned by scrubbing are highly unsatisfactory, and should never be used for school corridors. Asphaltum makes a good smooth surface, is fireproof, noise-deadening, and impervious to water. It is rather dark, and not particularly ornamental in appearance, but gives excellent service. Cement has most of the satisfactory elements of asphaltum, except that it is somewhat slower in drying after having been washed, and the surface gives off a fine dust when much used. One of the most popular forms of floor covering for corridors is made by embedding small pieces of marble in cement. These "terrazzo" floors, so called, furnish a waterproof surface, are light-colored and attractive.

The importance of well-constructed double floors is frequently unappreciated by people in country districts. Of the one hundred and nine one-teacher rural schools in New

York, New Jersey, Connecticut, Vermont, and Maryland studied, in 1913, by the American Medical Association and the National Council of Education, over one third had floors consisting of single boards laid on wooden joists, through which ground air, ground damp, and strong cold draughts poured in around the feet of teacher and children. Of the entire one hundred and nine, only one had floors lined with deadening material. In studying the reports of medical inspection, students are frequently shocked to find that the city child is healthier and stronger than his country brother. Rural children are exposed constantly to dangers from which city children are protected. It is probably true that much of the tuberculosis, catarrh, pneumonia, and deafness of country people has been caused or accelerated by years of living in rooms with cold, draughty floors. The cost of providing adequate protection against this very real peril is small compared with the loss of physical efficiency which is likely to result from its neglect.

Walls. School walls should be easily cleaned and of smooth surface, so that they will not catch dust. Plaster, wood pulp, cement, tile, terrazzo, or brick may all be used as wall surface, providing the cracks are eliminated, the whole polished to secure a smooth facing, and paint or stain applied so that walls are given the proper color. Wood gives a good effect if carefully set, but care must be taken to avoid cracks and panels, and to eliminate projections which would be likely to catch dust. Dark wood is attractive in appearance, but should not be used above the lower line of the blackboard, because it absorbs light. Various types of composition board are rapidly coming into use and are especially appropriate in the less expensive types of rural schoolhouses. Burlap, tapestry, or wall-paper should not be used for schoolroom walls, because the first two catch dust, and all are difficult to clean. No matter what material is used, care

should be taken to procure a dull rather than a glazed finish, in order that reflections may not interfere with the general lighting scheme.

Doors. The doors of the schoolroom should be without moulding or panels, and should depend for their beauty upon the grain of wood or the sheen of metal. Everything should be eliminated which in any way catches dust. The carpet strip at the entrance is entirely unnecessary if care is taken in hanging the door. It catches little piles of dust during sweeping, and should be done away with. Transoms above the door were originally intended to aid in securing good ventilation. With modern plenum systems the transom is apt to make trouble by causing extra draughts; and, even with systems of window ventilation, it seems undesirable to admit air from the central hallway. Transoms are of more hindrance than help in ventilating. They are often out of order, and usually shockingly dirty. Dust gathers on the slanted surface and cannot be removed by the ordinary broom.

Transoms, panels, and carpet strips are all remnants of an earlier and less hygienic age; and should be discarded.

QUESTIONS FOR STUDY AND DISCUSSION

1. Draw a plan of an old-type one-room rural-school building, with windows on three sides, stove in center, platform at front, with an entrance on each side of it leading into front hall. Show what changes should be made to improve the building, and calculate approximate expense.
2. What, if any, difference should be made between the orientation of school buildings where there is a one-session day and of those where there is a two-session day? Between high, grammar, primary, and kindergarten buildings?
3. What are the advantages and disadvantages of erecting school buildings with the corners facing the four cardinal points of the compass?
4. Under what circumstances is it justifiable to build a rural school on wooden piles, without cellar or foundation walls?
5. Which is better, in cases of overcrowded schools, to place children

in basement rooms, attic rooms, portable buildings, or increase the size of classes in regular classrooms? What is usually done, and why?

6. When an addition is to be made to an old-type school, with two-sided lighting, pitched roof, etc., how far should the external architecture of the new building correspond with that of the old?
7. Compare the relative advantages of cork, rubber, and linoleum as floor coverings.
8. Which is better for your community, a group of small buildings, or one large one? Why?

SELECTED REFERENCES

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Reproduces plans of buildings now being erected. Full of valuable suggestions.

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Dresslar, Fletcher B. *School Hygiene.* The Macmillan Company, New York. (1913.)

Valuable reference book.

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A five-year building program, including a discussion of policies concerning junior high schools, extending the normal capacity of the school plant, and the establishment of normal distances for the location of school buildings.

Monroe, Paul. *Cyclopedia of Education.* The Macmillan Company, New York. (1911–13.)

One of the most useful reference books for the student of education. Contains articles of value on immensely wide variety of subjects, and furnishes a brief but carefully selected bibliography with each.

N.E.A. Committee on Standardization of Schoolhouse Design and Construction. Frank Irving Cooper, Cornhill, Boston, Chairman.

Reports to be published. Will probably be of considerable assistance to schoolmen who face the building problem.

See also various State laws, and publications of State and local school authorities concerning building requirements.

CHAPTER III

ROOMS IN THE SCHOOL BUILDING

Classroom dimensions. The traditional classroom contemplates forty-eight children, in six rows, eight in a row, sitting one behind the other, silent and immovable, reciting occasionally, but spending much of their time in listening to the teacher talk. We are gradually changing our attitude toward schooling of this type. In the school of the future children will be busy doing things, not hearing about them. Fixed desks will disappear, and the classroom will become a workshop. Children will work in groups, moving actively about, and coöperation and communication will be cultivated as virtues instead of being repressed as cardinal sins of childhood. When that time comes, our architectural standards will undergo profound changes. Perhaps then unilateral lighting will be no longer necessary; classrooms may grow very much larger — or smaller; desks and chairs may be of many different kinds within the one room; blackboards may conceivably disappear. It is impossible for us to predict what changes will come, but we may be sure that schools will be very different from the best of those we now are building.

So long, however, as the child remains assigned to the traditional passivity of the classroom, the architect must provide him with surroundings as comfortable and hygienic as possible. Rooms must be small enough so that it will not be easy to crowd in too many children. The length of the room must be determined by the distance at which children in the back rows can read writing on the blackboard, and can hear and be heard. Width must depend upon the amount

of light which children farthest from the windows receive; the height of the ceiling must be that which provides for the best lighting and ventilation, while at the same time necessitating the least exertion in climbing stairs.

It is generally accepted as a standard that each child should have from eighteen to twenty square feet of floor space. and about two hundred and fifty cubic feet of air space. Various experiments with sight and hearing have placed twenty-nine feet as about the greatest distance at which letters one and a half inches high can be comfortably read; and thirty feet as the greatest distance within which the ordinary speaking voice can be easily and accurately understood. About twenty-nine feet, then, is the greatest distance at which any child should be seated from the blackboard. Add three feet for an aisle behind the last row of seats, and the length of the room comes to thirty-two feet.

The width of the room varies with the intensity of outdoor lighting. Assuming that the room is lighted on one side only, the desk farthest from the window should have as a minimum three foot candles of illumination. In countries well toward the north, such as Canada, England, Scandinavia, Holland, and parts of Germany, winter days are short, and the light of early morning and late afternoon is apt to be dull and weak. In such cases a room one and a half times as wide as it is high, with window space equal to one fourth the floor space, will be necessary in order to provide the desired amount of light at the more remote desks. In most parts of the United States a width not more than twice the height will give the same results. In the tropics, or on very high locations with low horizon lines, rooms even wider may be permitted.

Unless the horizon line is very high or the light badly obstructed, rooms should not be over twelve and one half feet from floor to ceiling. German authorities usually recom-

mend thirteen feet or more, probably because of the lighting difficulty encountered in northern latitudes. In the United States for a room thirty-two feet long, twenty-four feet wide, and twelve and one half feet high, five windows three and a half feet wide, eight feet high, and coming within six inches of the ceiling, will usually furnish sufficient light.

In crowded cities, even where the school authorities intend to assign no more than forty children to a teacher, it will frequently be found that old buildings, in which rooms are often twenty-eight feet wide or more, have actually desks and chairs provided for forty-eight instead of forty children. Because of their too generous dimensions the rooms do not look crowded, and it seems more economical and kinder to the children to make room for overflow classes by adding a few extra places than to erect portable buildings or use basement rooms. So long as extra floor space is available, additional seats will be installed. It is a wise plan to make the rooms in new buildings so narrow that any number beyond forty will not be admitted without obvious crowding.

High ceilings. Schoolhouses in this country were frequently very low, with small windows and no means of ventilation. As a reaction against such conditions the period after the Civil War produced buildings with ceilings not infrequently fifteen or sixteen feet high. At that time emphasis was placed upon the number of cubic feet of air the schoolroom held, rather than upon the frequency with which it was changed. Naturally, if air was thought of as being stationary, with only an occasional clearing, it was important to provide as much space as possible for every child. Modern ventilation demands a constantly changing current of air. If air changes frequently enough the actual cubic content of the room is held to be of comparatively little importance. In the older buildings windows were fre-

quently as much as two, three, or four feet below the ceiling, and the space above was filled with a mass of warm dead air which had risen from the space below and remained unchanged.

In schools depending upon window ventilation, where the windows come to within six inches of the ceiling, added space may be of value. The added height of the wall increases somewhat the pressure of cold air from without upon the warm air of the schoolroom, and thus quickens the air current. This is an advantage only where the teacher is skilled in operating the windows; and as teachers usually are too busy or forgetful to pay much attention to frequent ventilation, the advisability of installing higher ceilings is questionable. Moreover, every foot added to the ceiling height increases the height of the stairway. If the reader will visit in succession several of the old-type tall school buildings, and inspect them from attic to basement, he will soon appreciate the significance of the added foot. The strain of such stair-climbing upon adolescent girls is frequently harmful.

Avoiding unnecessary height is important for financial as well as hygienic reasons. Imagine a small building with say three thousand square feet of floor space, twenty-five feet high, costing twenty cents a cubic foot. The total cost of the building will be $15,000. Now, if the height of each classroom is increased by one foot, two feet are added to the total height, and six thousand cubic feet to the cubic contents; so that instead of costing $15,000 the building costs $16,200. That is, the total building cost has been increased by about nine per cent.

For elementary schools, then, the generally accepted standard for regular schoolrooms is twenty-four or twenty-five feet wide, thirty-two feet long, and twelve and one half feet high. It may occasionally be wise to adopt other meas-

urements, but the reasons for any departure from the figures here given should be carefully weighed. If forty children occupy such a standard room, each will receive about nineteen square feet of floor space and two hundred and forty cubic feet of air space. This cubiture is slightly below the usual amount demanded, but with a good system for changing air and keeping it in motion the space per child will be found ample.

In high schools where there are elective courses, and classes vary greatly in size, it is well to provide, in addition to regular classrooms of the dimensions just noted, a number of smaller rooms for groups of ten or fifteen students, and a few large rooms for lecture purposes.

Wardrobes. It was not until after the close of the Civil War that city schools were regularly built with special space set aside for the hanging of outdoor garments. Even at the present day there are to be found many rural schools where no such provision has been made. If special coatrooms are built outside each classroom, the doors should open into the room instead of into the hall, because in this way the wardrobe remains under full control of the teacher. Frequently a screen is erected across the back or front of the room, faced with blackboard on the outer side and fixtures on the side next the wall. A new method now being widely used, and very economical of floor space, is the wardrobe sunk in the wall just deep enough to hold the necessary fixtures, but not deep enough to allow children to enter the aperture. The opening is closed by sliding panels. Individual metal lockers with patented locks are rapidly coming into favor, especially for high schools or systems where, through the double-platoon plan, two sets of children use one classroom. Lockers are usually placed in halls or basements.

No matter what method is used for the disposal of wraps, care should be taken first to see that some system of special

ventilation is installed so that the clothing is dried and aired without allowing foul odors to escape into the classroom. Secondly, a hook for hat and wraps, shelf for lunch-basket, box for shoes and rubbers, and stand for umbrella should be provided for each pupil, and arranged in such a way that each garment is separated from those of other pupils. The spread of head lice or body vermin is frequently due to the careless manner in which hats or wraps are thrown in piles upon available chairs or window-sills; and it is frequently claimed that contagious diseases are carried in the same way. Individual lockers prevent all danger of this kind; but with proper fixtures the ordinary well-ventilated wardrobe may be rendered safe.

Special classrooms. In every school building it is usually wise to plan certain rooms which shall be smaller than the regular classrooms, and shall be used either for small recitation groups or for ungraded classes of fifteen children or so. The equipment of these rooms should in general be the same as that provided for regular classrooms. Frequently movable furniture is desirable here, even when it is not installed in all the rooms throughout the building. Rooms where classes are to be held for deaf, crippled, or blind children should be arranged after consultation with specialists. In classrooms intended for blind or partially blind children, for example, it is sometimes desired that the glass in the windows be amber-tinted rather than clear. In classes for the deaf special lighting in the front of the room is necessary, in order that the children may watch the lip movements of the teacher.

The sewing-room should be so planned that an abundance of clear light is available during school hours, without direct sunlight entering the room. Where sewing-rooms are to be used for only a short period each day by any given class, it is permissible to arrange them so that they will receive north

light. Art studios should also be arranged so that their light will come from the north.

All laboratories for cooking, chemistry, physics, and the like should be made thoroughly fireproof. Both ceiling and floor should be of fireproof material, and wherever possible separate exits leading directly outdoors should be provided for these rooms. In cooking-rooms special attention should be paid to the storage of fuel for the ranges. It is not unusual to discover piles of coal in the attic, under wooden beams which are entirely unprotected. Coal and wood which are needed for classroom purposes should be stored in metal-lined containers kept carefully closed. Special ventilating stacks, with exhaust fans or other means of rapidly changing the air, should be installed in all cooking and chemical laboratories, so that unpleasant odors may be removed speedily from the building.

Manual-training rooms are usually situated in the basements of the newer schools. Care should be taken to supply them with a plentiful light. It is usually true that basement classrooms, even in new and carefully planned buildings, receive an insufficient amount of light. The ceiling, walls, and floor of the manual-training room should be made fireproof, and a fireproof storeroom should be attached where lumber and inflammable materials may be kept.

Kindergarten. The kindergarten should be situated on the first floor of the school building and should be provided with a separate entrance, so that kindergarten children may go directly outdoors without walking through the other parts of the building. The kindergarten should include one large room, and one or two smaller rooms adjoining. These rooms should be so situated as to receive direct sunlight during kindergarten hours. In the regular classrooms, where children are obliged to sit still, direct sunlight is undesirable because it shines directly into the eyes and causes eye-

strain. In kindergartens, where little eye work is carried on and where children are allowed to move about freely, direct sunlight is probably desirable.

A large cupboard should be installed in which kindergarten materials may be stored. There should also be a separate toilet and washroom as part of the kindergarten suite, so that the little children will not have to be sent downstairs to the regular toilets. The fixtures in the kindergarten toilet-room should be placed very near the floor, so that children can use them without assistance. The floor of the kindergarten should be of some material which can be readily cleaned, and upon which children can sit without danger either of becoming chilled or soiling their clothing. Tile, terrazzo, or concrete are all undesirable because they are apt to chill the children. Battleship linoleum, carefully laid and treated with a preservative, is one of the most successful of floor coverings. Cork and rubber are also extensively used.

Open-air classrooms. There is wide diversity in the location of open-air classes. Some are held on the roofs of buildings, others on sheltered balconies, others in tents or shacks erected beside the main building, and still others in the regular classrooms with all the windows removed from their frames. Any one of these locations may be used successfully, providing certain precautions are taken. Where classes are situated on the roofs of city school buildings it is usually necessary to install elevator service in order to take the pupils up and down, because climbing several flights of stairs is not a desirable exercise for frail children. Open-air classes should have some sort of shelter provided which will keep the rain and snow from actually falling inside the classroom. Toilets and washrooms, with a plentiful supply of soap and hot water, should be on the same floor and close at hand. Unless there is a regular school lunch in the main building,

it is well to have a small kitchen where food can be heated and served. On one side a large storage closet is desirable; for the portable equipment of the open-air classroom is bulky and difficult to handle. Warm blankets and sitting-out bags should be provided for every child, and these must be kept in a dry closet at night. In addition to tables, chairs, blackboards, lunch equipment, toothbrushes, towels, and the like, a steamer chair, or, preferably, a cot bed must be provided for the use of every child.

Auditoriums. The auditorium should be located on the first floor, and provided with separate exits leading directly outdoors. The floor should slant from the back of the room toward the stage. At each outside entrance there should be a cloakroom with toilet-room attached, and a booth where tickets may be taken. By this arrangement the auditorium may be used for meetings of adults without its being necessary for them to go through the main parts of the building. The stage should be so arranged that it can be easily enlarged by moving the scenery, so that a comparatively large number of people may be accommodated upon it. It is usually desirable to provide simple stage equipment for lowering curtain, arranging scenery, and using special lighting. On each side of the stage should be a small room which can be reached without going through the main auditorium. A curtain should be provided on which stereopticon pictures can be shown. In planning to use the stereopticon the laws of the particular State in which the building is to be erected should be carefully examined, for in many places some special regulation has been passed concerning the use of stereopticon or moving-picture machines in non-fireproof or partly fireproof buildings.

Where the auditorium is to be used extensively for classes or study, careful attention should be paid to the question of lighting. Frequently the most effective manner of lighting

is to install glass in the ceiling rather than at the sides. Since it is not customary to erect other classrooms above the auditorium, overhead lighting is easily secured and may be made very effective. Artificial lights should be installed in such a way that, while ample illumination is secured, the source of light shall not be visible to members of the audience who are looking toward the stage. Indirect or semi-indirect methods of lighting are usually desirable for auditoriums.

The gymnasium. The gymnasium is usually located either on the top floor or else in the basement of the building. The latter is probably the more common plan, because it is usually easier to install showers, locker-rooms, dressing-rooms, swimming-pool, and running-track in the lower part of the building. Many of the newer schools, instead of one large gymnasium, have two smaller ones for separate classes of boys and girls, so that two groups may exercise at the same time. In planning the gymnasium special care should be taken to provide good ventilation and a plentiful supply of light.

The minimum amount of floor space in square feet should be calculated by multiplying the number of children in the average gymnasium class by twenty. Cement floors are commonly found in gymnasiums, but they are undesirable because they are too cold and hard. Moreover, unless especially treated, they give off a fine gray dust which rises in the air when classes are exercising. Cork and rubber preparations make very good floors, but these are exceedingly expensive, and they have the added disadvantage of making the gymnasium unavailable for dancing. Probably the most satisfactory floor covering is of carefully selected maple board. Where the gymnasium is located in the basement, with no other rooms beneath it, it is essential that if wooden floors are used, a large number of auger-holes be bored through the baseboard, and space be left connecting with the space

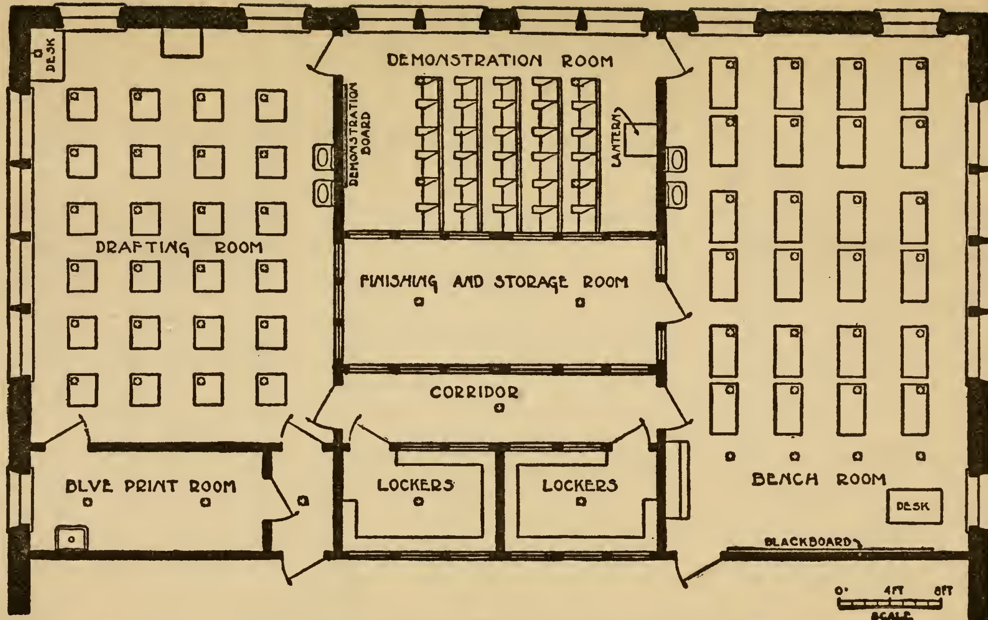

FIG. 6. TYPICAL MANUAL-TRAINING DEPARTMENT ROOMS

As required for all elementary schools in Pittsburgh, Pennsylvania

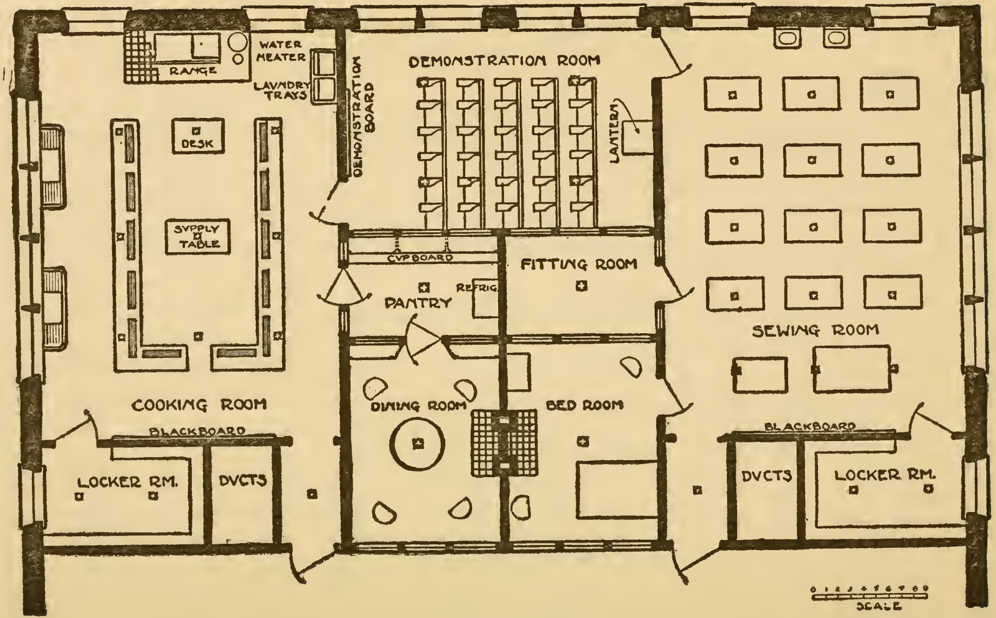

FIG. 7. TYPICAL HOUSEHOLD-ECONOMY ROOMS
As required for all elementary schools in Pittsburgh, Pennsylvania

beneath the floor, so that the floor may be well ventilated and dry rot prevented.

Attached to the gymnasium there should be two small rooms, one for storing apparatus and the other for the use of the gymnasium teacher and medical inspector.

Libraries. To an increasing and encouraging degree the public schools are becoming branches of the local public libraries. In some communities a shelf in each classroom is filled with library books, which are changed twice a month. In other places there is a central room, holding collections of books owned by the school and other books lent by the library, where children may go and study during class hours. Sometimes these rooms are open in the evening, and children are encouraged to do their studying at school rather than at home. In a few cases we find regular library rooms, with trained librarians in charge, to serve the needs, not only of the children in the school building, but of the people in the community as well. This latter plan is so rapidly increasing in favor that we find a large number of our newest school buildings providing library rooms for community service. These rooms are necessarily so located that access can be had to them without entering the rest of the building. They are usually on the first floor, although rooms on the second floor may be used if outside stairways lead directly to them. Occasionally the library is established in a wing of its own, or even, in some cases, in a small outside building, so that it may be heated properly at night without the expense of heating the rest of the school building also.

No matter how simple a library may be, there should always be room enough for children to sit down and study or read without having to take the books away from the room. A plentiful supply of light should be admitted, and if chairs are movable this light may be on more than one side of the building. Overhead lighting, if carefully installed so that

direct rays will not fall through the glass, is frequently found exceedingly effective. Tables should be provided on which to rest books, but care should be taken not to have these tables too high. The library tables should be about the same height as the desks which most of the children use. This means that in primary schools they should be much lower than in high schools. In buildings where classes of different ages are accommodated, tables should be supplied of varying sizes. The chairs should be selected in much the same way; different-sized chairs being provided for different-sized children. Care should be provided to see that the chair provides proper support for the back when an upright position is assumed. Artificial lights carefully placed and plentiful in number should be supplied for night use.

Lunchrooms. Where children stay at school during the noon hour, or where penny lunches are served during the morning recess, a special place should be provided for serving and eating lunches. The lunchroom should be quickly and easily accessible. When it is placed on the top floor of a building, for example, attendance will be much less than when it is placed in the basement or on the first floor, because children are not willing to climb stairs, unless compelled to do so. Where large numbers are to be served, direct exits should be provided so that children can reach the playground without loss of time.

The lunchroom may often be planned so that during hours of the day when lunches are not being served it may be utilized for other purposes. It is not uncommon to find lunchrooms in the basement playroom or in large corridors. In some cases the lunchroom is in a large first-floor room which is also used by regular study classes. Since the room is already equipped with table and chairs, this is probably a good arrangement, especially if such a room is made to open off the main library and if it is properly cleaned after each

meal. The lunchroom should be well lighted and should be provided with special ventilation. It should be easily accessible from outdoors and from the rest of the building. If possible, chairs and tables should be provided for the children, but where space is inadequate, long settees, or, better still, movable chairs with one broad arm, should be provided so that the children can sit down while they eat.

The kitchen and serving-room should open off one end of the main dining-room. Counters or long tables should be provided on which to display food for sale. A ticket booth should stand near the entrance, and it is also usually desirable to have an aisle railed off to prevent children from coming in in groups. A clear passage should also be left through which soiled dishes may be carried to the washing-room. The kitchen should be built with fireproof walls, ceiling, and floor. It should be well lighted and heated and should be provided with special ventilation. Beyond the kitchen should be a large storeroom which is kept cool and dry, and a small dressing-room where the workers can change their clothing and hang their outer wraps. This dressing-room should be provided with washing and toilet facilities. The kitchen floor should be warm. Where basement space in old buildings is being utilized, the floors are often of concrete and very cold. In such places it is usually well to provide mats of wooden slats to place in front of the sink. A plentiful supply of shelves and drawers should be installed in the kitchen and service-room to hold the necessary lunchroom equipment.

Dispensary. Every school building should have a dispensary for the use of school physicians and nurse. In old buildings this may either be the end of a corridor or part of the basement, partitioned off and carefully finished, with wooden floors and walls. There are very few buildings in which some space cannot be found which with thought and

ingenuity can be made into a satisfactory dispensary. Walls and ceilings should be painted white and made so that they can be easily washed. Opening off the main dispensary should be a small dressing-room containing washstand and toilet. The dispensary should be provided with a couch, a pair of scales, a cabinet for holding medical supplies, a waste-basket, several chairs, and a table.

Office. The principal's office should be so located that it can be easily and quickly reached from every part of the building; and it should also be near the main entrance, so that visitors to the school can find the office quickly. Perhaps the commonest location is either to the right or the left of the main entrance on the first floor, although it is frequently on the second floor directly at the head of the stairway. Where possible it is advisable to have a small reception-room attached to the main office. Both reception-room and office should be well lighted and furnished attractively, with comfortable chairs and tables. In the office there should also be a modern flat-top desk for the principal, a good-sized bookcase, and a vertical filing-cabinet for correspondence and cards. A large closet should open from the main office, in which may be stored materials for temporary study. Attached to the office there should also be a small dressing-room, equipped with toilet facilities.

Teachers' room. In every building there should be at least one, and in large buildings there should be more than one, room set aside for the use of the teaching staff. Where men as well as women are employed there should be separate rooms for each sex. These rooms should be attractively furnished. They should be provided with a fair-sized table and several comfortable chairs. On one side there should be a full-length lounge with one or more pillows and a steamer rug. In a corner of the room behind a screen there should be provided facilities for heating food. In old buildings the

stove may be heated by gas or oil, but in new buildings, where electricity is available, by far the most convenient arrangement is an electric plate. A shelf should be provided below on which cooking-utensils may be stored, and a small cabinet is desirable for the care of cups and plates. It will also be found convenient to have in the teachers' room a small bookcase for books and magazines. Toilet and wash-room, with a good mirror and a plentiful supply of towels, should open off the main room.

The janitor's room. The janitor is probably the most neglected person in the whole school system. A good janitor is harder to find and harder to replace than a good teacher, and, in most cases, than a good school principal. He has a longer working day than any one else in the system. During extremely cold weather in the winter he sometimes must reach the schoolhouse as early as four o'clock in the morning, and has to stay there until eleven at night, in order to keep the fires going. Yet it is an exceedingly rare thing to find a school building equipped with a comfortable room set aside for the sole use of the janitor. Where any space at all exists, it is frequently a small cubbyhole opening off of the coal-bin, and roughly boarded in with whitewashed walls and cement floor.

The janitor's office must usually be located in the basement, but this is no excuse for making it ugly and uncomfortable. It should be near the boiler-room, but so located that it is well lighted and receives direct sun during part of the day. The floor should be of wood, linoleum, or other covering, such as is used for regular business offices. A good-sized desk should be provided, with filing-drawers for the filing of correspondence, accounts, and other papers which the janitor must handle. There should be a comfortable armchair and two or three other chairs, and it is also probably desirable to furnish a comfortable couch. Beside

the desk there should stand a telephone which connects with the principal's office. Where a system of thermographs is installed which shows the condition of the temperature in each room, the recording apparatus should be established in the janitor's office. There should also be direct connection from his office with the fire-alarm system. Opening from one side should be a small toilet-room with hot and cold running water. With a little intelligent planning almost every school building may be provided with a comfortable and well-equipped office for the janitor. The resulting increase in the efficiency of service rendered will be ample evidence that the investment is a wise one.

Storerooms. In most school buildings too little attention is paid to the question of storage space. It is not uncommon to find shelves placed at the foot of the attic stairways, or even in cupboards under the stairways. Both of these places are bad. On the one hand, they do not provide enough space, and on the other, they are a constant source of danger from fire. The attics themselves should never be used as storage places, for the same reason. Certain materials may successfully be kept in the basement, but in old buildings basement storerooms are apt to be damp, so that material stored there becomes rusty or mouldy.

It is probably desirable to have at least two storerooms in the building. One may be in the basement, carefully arranged to avoid dampness, and intended for storing janitor's supplies. The other storeroom should be above the basement level and should be used for storing books, papers, and so forth. Rooms where inflammable materials are stored, such as paints, oils, raffia, and the like, should be built with fireproof ceilings, walls, and floors. Where sprinkler protection is installed in a building it is usually wise to have sprinkler heads in the ceilings of these storerooms.

QUESTIONS FOR STUDY AND DISCUSSION

1. Outline the changes in architecture and equipment which would have to be made if your own educational philosophy were fully lived up to.
2. What are the standard instruments for measuring light? Which are the most applicable for school purposes?
3. Make a study of typical high-school programs, and with this as a basis specify the number and dimensions of classrooms which would most efficiently meet the present demands of each school.
4. Compare the advantages and disadvantages of room wardrobes, sunken wardrobes, lockers, etc., and their location in classrooms, halls, or basements.
5. How should a classroom for partially blind children differ from that for the deaf? For mental defectives? For truants?
6. How should the size of an auditorium be calculated? What special considerations should be kept in mind?
7. For what purposes may flat roofs be utilized?
8. What plans have been placed in operation for combining gymnasiums and auditoriums? What are their respective advantages and disadvantages?
9. Are school authorities justified in building auditoriums which are used only three times a year? For half an hour each morning? What is the basis for deciding?
10. How may cement floors be prepared for dancing? Linoleum floors?
11. Outline a plan for coöperation between the public library and the public schools. What is your opinion of Cubberley's proposition that the public libraries and museums should be under the direction of school authorities?
12. How much storage space should be allowed for an eight-room elementary school, and how should it be distributed?

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CHAPTER IV

CLASSROOM EQUIPMENT

Platform. The teacher's platform probably originated in the days when, under the old Lancastrian system, one teacher with a few pupil assistants was placed in charge of a schoolroom containing often as many as three hundred children. With any such number as that it became exceedingly important that the teacher be given a point of vantage from which to see what was going on. Wilderspin, with his infant school, tried the plan of seating children upon wide steps rising one above the other, not unlike circus seats. This arrangement is still common in the primary schools of England. For the older children in this country in the early days we find slanting floors, small platforms each lifting a row of seats above the row in front, seats themselves graduated in height, platforms along the rear of the room, and finally the front platform which has remained until the present day. Now that the number of pupils per classroom has been materially reduced, the need for a raised platform has disappeared. From the hygienic standpoint the raised platform is a dirt-gatherer and a nuisance. Pedagogical reasons are equally against it; and the two forces combined are banishing the platform from the schoolroom.

Blackboards. The front, back, and right-hand walls of most schoolrooms are lined with blackboards, or what were known in the early days as "lecture boards." The first form was several planed boards nailed together and painted black. Sometimes the teacher's desk was painted black on the outside and its front panels used as writing space for the younger children. At the present time there are many

different forms. Prepared cloth or strong black paper is useful for temporary work, especially when charts or signs must be carried from building to building. They should never be installed as permanent blackboards. There are very many different forms of paper or wood-pulp composition boards pressed into sheets which are fairly satisfactory for brief periods. They are pleasing in appearance, easily mounted, and inexpensive. Most of such preparations, however, cannot be washed without absorbing water, become damp during rainy weather, gradually grow oily, and in time buckle or chip. Composition blackboards are rarely wise investments.

Perhaps the commonest form of blackboard now in use is made by covering brick or wood lath with plaster, and painting the surface. These plaster boards crack in fine lines, and frequently blister and peel. They are rapidly going out of use. A fairly satisfactory board on much the same principle may be made by setting up a solid backing of wood, brick, or cement, laying metal lath upon it, and then applying a smooth layer of good-quality cement, colored black, with just a tinge of green. If a wood backing is used, care must be taken or the absorption of water will cause the cement to crack as it dries. Cement boards are apt to be of different colors in different parts of the room, owing to the necessity of mixing in small quantities; and after being used for some time they frequently fade or spot. Even when great care is used in smoothing the surface, the grain is usually so rough that chalk is quickly worn down. There are on the market several varieties of material to be laid on in a similar way, most of which are open to the same objections.

It is said to be the common practice in England to make blackboards out of heavy sheets of glass, ground as smooth as possible on one side and rather rough on the other. The

rough side is painted any desired color, and the board is then mounted with the rough side toward the wall. The smooth face presents an excellent writing surface, and the strokes made by the chalk stand out clearly against the painted background. Grinding must be done carefully so that any remaining roughness will not cut too deeply into the chalk. Glass blackboards are rather expensive, and have been little used in this country. It is rather unfortunate that more experiments have not been carried on with them; for while they break easily during transportation, when once set up they are durable, easily cleaned, satisfactory to write upon, and may be given any desired color. It is not improbable that at some time we may have "blackboards" of glass tinted in buff or cream, and dark-colored chalk used instead of white. Such a change would probably be of benefit to the eyes, and certainly would make an immense change in the general attractiveness of the schoolroom.

Slate blackboards were introduced into this country early in the nineteenth century. It is interesting to note that among the arguments in favor of slate, as opposed to painted wood, was the suggestion that slate pencils might then take the place of chalk, and much disagreeable dust be avoided. At the present time the best schools in the country are equipped throughout with slate boards; and, when cut in large slabs and carefully set up, this material is probably the superior to everything except glass. Unless great care is used in fastening the slabs to their backing, cracks are left between portions. Frequently slabs warp, and the joints jut out so that chalk and eraser often knock against them. Slate is expensive, but practically never wears out. It can be washed freely. If care is taken in selection and installation, the slate blackboard gives good service. Slate or glass should be the only materials used for blackboards in new school buildings.

Placing and heights. Blackboards should never be placed between windows, because when children face directly toward the light the pupil of the eye contracts so as to shut out part of the glare. When they are in this contracted condition any attempt to read what is written on the wall next to the window is difficult, and often positively harmful, because the eyes are not properly adjusted for such work. In rooms lighted from the left side only there will be no space available for blackboards between windows, but boards may properly be placed upon the other three sides. Most of the work of the students should be done upon the board directly opposite the windows, since it is here that the work is most easily read by others. The board at the front of the room should be especially planned for use by the teacher.

In the first and second grades the boards at side and back should be placed twenty-four inches from the floor, and should be twenty-eight inches wide. In the third and fourth grades they may be set twenty-seven inches from the floor and be thirty inches wide; in the fifth and sixth grades, thirty inches from the floor and thirty-two inches wide; in the upper grammar grades, thirty-two inches from the floor and thirty-six inches wide; and in the high school, thirty-six inches from the floor and forty inches wide. In each case the distance from the floor is determined by the height at which smaller pupils in each grade are able comfortably to write upon the blackboard; while the width recommended is that which will give the needed amount of writing area without adding unnecessary surface of light-absorbing material. If, as has been previously suggested, the glass board with cream-colored background ever becomes a part of our school equipment, the width may be materially increased without danger of eye-strain. The teacher's board at the front of the room should be thirty-six inches from the floor and forty inches wide. Children will rarely be required

to write upon this board; its height should be convenient for the teacher's use; and it should be easily seen from seats at the back of the room. In ungraded classes the board should be twenty-four inches from the floor and from thirty-six to forty inches wide. Light-colored curtains should be provided to cover the boards when not in use.

Dust and erasers. The alarming prevalence of tuberculosis among school children and teachers is frequently charged to the excessive amounts of chalk dust which fill the air of classrooms, are taken into the lungs, and irritate the delicate surface of the breathing tracts. Chalk seems to be a necessary classroom tool, but with proper care may be prevented from doing harm. Dustless crayons are now on the market which are a distinct improvement upon the soft plaster-of-Paris preparations which were formerly widely used. Soft chalk, which easily crumbles and writes with too thick a line, should be eliminated from the schoolroom and its purchase should be prohibited. A trough should be placed below each board, with a deep depression to catch the dust. A wide-meshed wire screen, fastened with hinges, should be placed across the top, so that erasers may rest upon it instead of being allowed to rest directly upon piles of powdered chalk. The hinges make it easy to lift the screen and clean the troughs at the close of each session. For schools where vacuum cleaning plants are installed, there has been devised special apparatus for removing chalk dust from troughs without the labor of using dustcloth or brush.

Fifteen years ago cleaning erasers was a privilege highly coveted by all the class, and the good little child with weak lungs, chronically too tired to get into mischief, was usually awarded the honor. It was a common thing to see children at open windows, holding a wooden eraser covered with felt in each hand, and energetically clapping them together to remove the dust. The open window usually created a draught

and the cooler outside air was sucked into the room, carrying liberated particles of chalk back with it and covering hair and faces of the monitors with soft grayish-white powder. Even to-day there probably are teachers who carry on the custom, but in most cases such indefensible action is due to ignorance rather than to intentional cruelty.

If erasers must be whacked against hard surfaces in order to clean them, the work should be done well away from the school building, in the open air, by an adult person with strong lungs. There are, however, on the market several different kinds of machines for this purpose, all of which are designed to catch the dust as it escapes without permitting it to fly out into the room. Some of these machines are equipped with revolving brushes; others draw the dust out by means of a vacuum pump. Several of the designs are effective and inexpensive, and within the reach of every schoolboard. If a vacuum cleaning apparatus has been installed in the building, a hose attachment with a long narrow opening can easily be provided in the basement by means of which the janitor can clean all erasers.

Desks and chairs; rules for placing. Ever since before the days of Horace Mann we have been experimenting with schoolroom desks and chairs. Scores of different models have been devised and theories evolved, each securing its own small group of ardent advocates. At the present time there seems to be even greater diversity than before; and the suggestions advanced may be roughly divided into three main groups.

The first and largest group contemplates a continuance of the present educational method by which children are expected to spend most of their time in sitting still. Under such a system it is necessary to provide chairs and desks which will be comfortable, and do no more harm than is unavoidable to growing children. Most suggestions for school-

Fig. 8. The Evolution of the Schoolroom Seat

Fig. 9. A Movable Schoolroom Chair
Now much used. A drawer under the seat holds the books. The desk arm is adjustable

room furniture fall under this head. There are few definite rules which are followed by all the advocates of fixed desks and seats, but the following suggestions are commonly accepted: —

1. *Adjustment.* Desks and chairs should be adjusted to the height of the child. This may be done either by supplying several different sizes for each room, or by making any individual piece of furniture so that it can be adjusted to the needs of the person using it. In buying furniture it is well to make sure that the adjustments can be made swiftly and easily. Many janitors find this one of their most tedious tasks. Furniture has been devised with a simple crank arrangement which raises or lowers chair or desk while the child is actually in his place. The work can be rapidly done by an older pupil under the teacher's direction.

2. *Inspection.* This should be made after every promotion period to see to it that adjustment has actually been made. Practically all city superintendents admit the necessity of supplying furniture of different sizes, or else adjustable furniture, but there are few cities in which more than three fourths of the children are so supplied, and there is hardly a city in the country where such adjustable furniture is actually adjusted after each promotion period.

3. *Should be single.* That is, each desk or chair should be intended for one person only. In Europe and in some parts of this country the old style of double desks and chairs is still retained, but the custom is rapidly disappearing. Double seating usually means lack of adjustment to the individual child and interference of one child with his fellow.

4. *Feet and floor.* Seats should be low enough so that the pupil's feet rest squarely on the floor; otherwise the blood vessels in the under part of the thigh become constricted and retard circulation. In exaggerated cases it is claimed that the thigh bone actually becomes bent and the child is

permanently deformed as a result of continued sitting on too high a chair. Dr. Dresslar suggests that the proper height of the seat is approximately two sevenths of the height of the child. On the other hand, seats should never be so low that the knee is raised above the level of the hips.

5. *Rounded corners.* Seats and desks should be rounded at the corners, in order to prevent possible injuries.

6. *Shape of seat.* Seats should be slightly hollowed out to fit the natural curve of the body, instead of being flat like a settee. The width of the seat from back to front should be that which affords sufficient support for the body, but at the same time brings the back of the body against the back of the chair. Burgerstein suggests a width of two thirds the thigh length.

7. *Tilting of seat.* Many authorities claim that the seat of the chair should be tipped slightly back, as are the seats of rocking-chairs, so that the body is easily brought in contact with the back rest.

8. *The support for the back.* The back rest should be tipped slightly, and should afford support for the spine. It is on this latter point that recommendations differ most widely. Many authorities claim that the chair back should not rise above the lower part of the shoulder blades. Others demand hip rests rather than back rests. Some claim that chairs for girls should have a greater curve inward than chairs for boys. Many persons emphatically demand that every chair be equipped with a movable back rest, which can be raised or lowered and is intended to support "the small of the back."

The facts seem to be that in a correct sitting posture the spine shows a slight inner curve, but that this curve is much more shallow in sitting than in standing. The inward spinal curve of adolescent girls is greater than that of boys. Support should be given to the spine, and may be supplied either by the naturally curved back of the chair, or by movable

rests which can be adjusted to the needs of the individual child. In this connection it is important to note that great discomfort may result either from placing the supporting pad too low or in allowing it to project too far forward. The old "liver-pad" form of seat, which was highly recommended some time ago, furnished a low back fitting closely against the lumbar region of the spine. This design has since been generally discarded because it was found that in many children long hours of sitting in such a seat produced bladder trouble, accompanied by excess of albumen in the urine.

9. *The "minus distance."* Desks should be so placed that the top of the desk projects over the front of the seat, and yet sufficient room is provided to allow children to rise without crowding. The accepted standard for this relation of chair and desk is that a plumb line dropped from the center of the front of the desk should mark a point one and one half inches in from the front edge of the chair. This overlapping of the chair and desk is known as "minus distance." Where the front edge of the desk is exactly above the front edge of the chair the condition is known as "zero distance," and where there is a space between the two edges it is known as "plus distance." It is unfortunately true that in some of our leading school systems, where the most approved types of furniture are being installed, the actual screwing fast of chairs and desks is done without adequate supervision, and zero or plus distances are frequently the result.

What plus distance means to the child who is forced to occupy the chair will be realized by any one who has had experience with certain lunch-places where revolving stools are fastened to the floor at some distance from the counter. Where the stools are also so high that the customer's feet dangle into space and a foot-rail is not provided, one is given a vivid sample of the discomfort suffered by all too many of our school children.

10. Desk height. School men vary widely in their standards for desk height. One of the most common statements is that when the forearm rests on the top of the desk it should form a right angle with the upper arm. As a matter of fact there are practically no desks on the market which can be adjusted as low as this, because the space between elbow height and knee is less than the depth of the book box. The commonest practice is to place desks about the height of the end of the breast bone. Adherents of the high desk claim that the low desk causes round shoulders. Adherents of the low desk claim that the high desk results in cramped chests and crooked backs and eye-strain. It seems to be true that the lower the desk the more it must overlap the front of the seat. A pronounced minus distance with low desk combats rather successfully tendencies toward round shoulders. While few hard-and-fast rules can be laid down, it seems probable that further experiments will put book boxes at the side or under the chair, lower the desk from breast line or elbow, and push the chair well under the desk.

11. Desk-top slant. The top of the desk should slant in order that books and papers may be held at as near a right angle with the line of vision as possible. With the flat table papers are often at a wide obtuse angle, and the result is that in order to see easily the student is obliged to place his book on an upright support or else bend forward. The gentleman at the restaurant table who stands his evening paper against the sugar bowl does so because of a strong hygienic impulse. It should be noted also that increased distance between chair and desk increases the distance from eyes to book, and the obtuse angle between the book and the line of vision. Suggestions as to the proper slant range from ten to forty-five degrees. Adherents of the extreme slant bring forward as arguments engravings of the desks used in medieval monasteries for some of the most beautiful writing ever

FIG. 10. TYPES OF ADJUSTABLE SEATS AND DESKS

(*a*) Teacher adjusting chair and desk to the boy (*b*) Boy adjusting seat

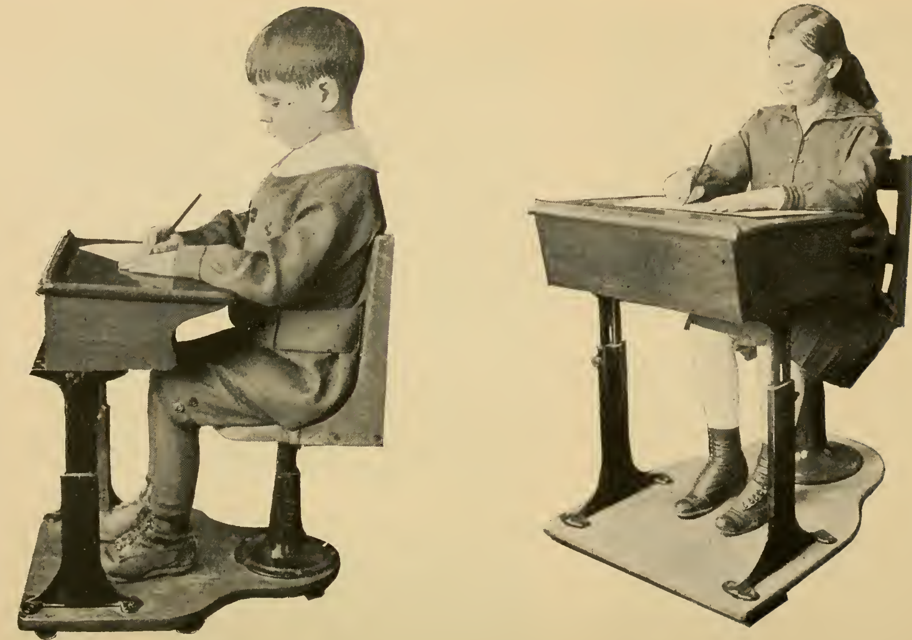

FIG. 11. ADJUSTABLE SEATS PROPERLY ADJUSTED
(*a*) (Boy) (*b*) (Girl)

done. These desks were slanted at an angle of about fifty degrees. Ink was used, and the pens were of poorer quality than those of the present day. People on the other side state that at such a slant books, papers, and pencils slide to the floor, ink will not run, and the child is hidden from the teacher.

In general it may be stated that the nearer the desk top is slanted to a forty-five degree angle during reading or written work the better it meets the requirements of vision, and the less danger there is of spinal curvature due to faulty sitting position. Practically, although many desks with adjustable lids have been invented, very few have proved satisfactory. Usually the mechanism is elaborate and apt to get out of order. Desks slanting at fifteen degrees are commonly manufactured, and are much superior to the flat top. For the present many school men will feel that the fifteen degree desk is the only one sufficiently durable and simple for wide schoolroom use.

The importance of procuring a greater slant is, however, so great that every superintendent should bear in mind the possibility of devising satisfactory desks. Whenever a desk is brought to his attention which seems to combine new and desirable features the superintendent should see to it that a few samples — say five or six — are purchased and placed in the regular schoolrooms to be tried out by teachers and pupils. Through such a plan of experiment and criticism it should not be long before the up-to-date superintendent is able to secure desks and chairs which will be easy to adjust, inexpensive, and in accordance with rules of hygiene.

12. Movable top. Some arrangement should be made whereby the front of the desk may be drawn toward the pupil when he writes, so that the forearm will receive adequate support. When this is done the angle between the line of vision and paper is considerably lessened.

13. Pedestal chairs. There are various types of chair and desk supports on the market. Most chairs are placed on a single pedestal. Desks are either supported by one pedestal at the center back or by a leg on each side. It is probably desirable to use the one pedestal method wherever furniture can be found so manufactured that the pedestal can be fixed firmly to the floor and will not pull loose. The furniture now on the market varies so greatly in this respect that care should be taken to experiment with different samples before buying. Single-pedestal furniture makes the problems of cleaning very much simpler for the janitor, because it furnishes few crannies in which dirt and sweeping compounds can lodge.

The use of one pedestal for a desk and the chair in front of it is usually not wise, because it makes rearrangement of furniture difficult, sometimes prevents adjustment to fit size of pupil, and usually allows the desk to be shaken by movements of the child who sits in the chair attached to it.

Movable furniture. Most school men regard the fixed chair and desk, for the present at least, as a necessity. There are a few, however, who earnestly advocate some form movable furniture. A pioneer in the movable furniture movement was Horace Mann, together with Joseph W. Ingraham and other co-workers. Mann advocated small armchairs, with boxes for books placed at the side, back, or under the seat. No lapboard was considered necessary. These chairs were widely used in the Boston primary schools, and Henry Barnard, in speaking of them somewhat later, declares that they were exceedingly successful.

During the past few years the agitation in favor of movable furniture has again come into prominence. Several varieties are on the market. Some are made with broad arms on the right-hand side, similar to the chairs so commonly used in college lecture-rooms. Others are adjustable

in height, with swinging arms. The rules just cited as to height, width, back, etc., hold good whether chairs are fixed or movable. The chief difficulty so far experienced with movable furniture is, that it is so constructed that it gets out of order easily, or else the writing-shelf is poorly braced and unsteady. Very few types have the desk attachment properly slanted. The various designs are constantly being revised, and doubtless before long we shall have available movable chairs and desks which will be as comfortable and durable as the better class of fixed furniture.

From the point of view of educational method, movable furniture is desirable because it renders the school program more flexible. Space may be cleared in the center of the room for games or dramatic presentation. Chairs may be carried outdoors. Classes may be divided into five or six small groups, working in circles in different parts of the room. In such uses, however, care must be taken, whenever children are expected to sit quietly for as long as half an hour, to see that each child has found his own chair which is properly adjusted to him. In moving the chairs about it is an easy matter for children to become confused.

Workroom furniture. In addition to those who argue in favor of fixed or movable furniture, there is a still smaller third group of educators who believe that it will not be long before present educational methods will have been discarded, and the classroom become a place where children are active at various tasks which require moving from place to place. In such a room there might be rugs for children to use in sitting or lying upon the floor, as is the case in the Montessori school. There would probably be movable chairs of different sizes, tables for one, two, or three workers, tables at which children stand instead of sitting, long work-benches, and the like. The leaders of the new movement are as yet very indefinite in their planning, but it is probable that with

new educational theories and experiments the traditional furniture of the classroom will gradually be displaced by equipment better suited to the needs of children who are actively learning.

QUESTIONS FOR STUDY AND DISCUSSION

1. Dr. Dresslar, in his article on "School Architecture" in Monroe's *Cyclopedia of Education*, says, "in the churches and early schools the priest-teacher spoke *ex cathedra;* the fixed platforms in grammar schools are the remnants of these . . ." What is your opinion? Why?
2. What does the installation of a platform imply as to classroom method?
3. Why should windows in unilaterally lighted rooms extend nearer the back than the front?
4. In rooms lighted from two sides, what is the desirable arrangement of blackboard space?
5. In inspecting buildings how can one tell by brief examination whether blackboards are of slate, cement, composition board, plaster on wood lath, plaster on brick, or paper?
6. Why are not glass blackboards more popular in this country? Where they have been used what objections have been raised?
7. In some schools wide frames holding scrolls of cheap paper are used instead of blackboards. What are the good and bad points of this practice?
8. Make a collection of samples of chalk from different firms, and decide which is best for regular school use and why.
9. What different devices are on the market for cleaning erasers? Compare as to principle, simplicity, effectiveness, speed, durability, and cost.
10. How does the theory of the "normal surface of distribution" apply to the question of school furniture? Under what conditions may most of the chairs and desks in a classroom properly be non-adjustable?
11. What different devices are there on the market for quick adjustment of furniture? How do they work?
12. What should be the relative responsibility for having chairs and desks adjusted; of the teacher, principal, janitor, child, physical training teacher, school nurse, medical inspector, superintendent, and parent?
13. Why is it that the shelf for a typewriter in an office desk of the flat-top type is usually sunk five or six inches below the desk level? What angle is formed by the typist's forearm and upper arm? If typewriting were done with one hand only could the machine be raised? What bearing has this discussion on the question of school furniture?
14. In some States there exist legal provisions against installing movable furniture in public schools. Why? How valid are the reasons given?

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CHAPTER V

LIGHTING

1. Natural Lighting

Unilateral. We have already discussed at some length the placing of school buildings with respect to the points of the compass and the lighting. When the subject was first under discussion, various plans were suggested whereby lighting might be allowed from two sides — left and rear, or left and right, but during recent years the arguments in favor of unilateral lighting have been generally accepted. Since most children are right-handed, the right hand and arm are placed upon the desks in writing. Light coming from the right hand must then cast the shadow of the hand upon the writing surface. For this reason lighting from the right is undesirable. When from left and right, cross-lights are established which are confusing to the eye. Light from the rear is undesirable because of its serious effect on the eyes of the teacher. As was stated in the earlier part of this chapter, it should be an unbreakable rule that no blackboards should be placed between windows. Therefore, if adequate blackboard space is to be secured the windows must be banked on one side.

Breeze windows. In warm climates it is often desirable to place narrow windows, known as "breeze windows," close to the ceiling at the back of the room, or on the right side opposite the main windows. These breeze windows should be hinged on the lower side, and closed by means of cords and catches. Each window should be made tight against driving rains, and covered permanently with an opaque shade. The amount of draught caused by these windows may be regulated by changing the size of the opening.

Orientation. Classrooms should be lighted from the east or west. Those on the east receive the sunlight during the early part of the morning, but after about ten o'clock the sun has risen high enough so that direct rays no longer enter the window. Classrooms on the west receive direct rays of sunshine during the latter part of the afternoon. For this reason it will often be found wise to give lower-grade children, who are dismissed at an early hour, the western rooms, and upper-grade children eastern rooms, where after the first hour of school there is little trouble with direct sunshine.

Glass area. In northern countries the actual glass area of windows should never be less than one fourth the floor space. In countries of the temperate zone the glass area may be not less than one fifth, although one fourth is preferable. In the tropics it is probably better to make the glass area one fifth of the floor space, and one sixth is permissible. Wherever the sky-line is high, the air filled with smoke, or light otherwise obstructed, the window surface should be correspondingly increased. It should be remembered that while it is very easy to exclude unnecessary light, it is peculiarly hard to increase light when windows do not supply enough.

Placing. Windows should be placed in batteries along the left wall, and as near the back of the room as possible. Often in otherwise very well-arranged buildings one will find the windows evenly spaced along the side, or somewhat too far toward the front. In such cases the front blackboard, on which the teacher places illustrations and explanations, — probably the most important blackboard in the room, — is frequently subjected to a glare from the side windows which is not only exceedingly annoying to pupils, but is actually harmful. When windows are placed well back beyond the first row of seats the danger of such glare on the front board is removed.

Square tops. Windows should reach within six inches of the ceiling, and should be finished square at the top. It has been stated that one half of the sunlight received through the window comes through the upper third of the glass. If this be true, the upper third then is a most important area, and every square inch should be utilized. The old-fashioned pointed or arched window cannot be afforded in the modern school. Even curtain rollers or other fixtures should be removed from the top of the frame, because they cut off light which would otherwise find its way into the room. Since during most of the hours of the day sunlight enters the room in slanting rays, only those coming through the upper panes can possibly reach the farther desks. One of the most effective ways of improving lighting at these desks is to remove every obstruction from the upper six inches of the window space.

Height from floor. The lower part of the window should be not less than three and not more than four feet from the floor. Three and a half feet is a height commonly chosen. If the sill is much lower than this the outer row of desks receives an over-supply of sunlight, which in some cases may be painful to the eyes of the child sitting there. Light which enters below the level of the eye is bound to cause irritation, because it over-stimulates the retina, which is at the same time striving to adapt itself to the light which falls from overhead. It is frequently urged also that when the windows are too low, children are able to see what is going on outside without rising from their seats, and as a result it is hard for the teacher to keep their attention upon what she is doing. If windows are higher than four feet it is usually impossible to provide sufficient glass area without using more than one side of the room.

Frames and supports. Every possible square inch of window space should be filled with glass. This means that the

Fig. 12. Remodeling a School Building to improve the Lighting

The Friendship School, at Pittsburgh, Pennsylvania

(*a*) Before remodeling. One of the most poorly lighted buildings in the city

(*b*) After remodeling. The lighting conditions have been remedied to the greatest possible degree

Fig. 13. Overhead Lighting in an Elementary-School Assembly Hall at Holly, Michigan

old thick piers of masonry beween windows must be entirely done away with. In their stead come narrow steel piers, beveled on inside and out, so that slanting rays may be allowed to enter. Lintels, mullions, and piers are all of steel, and all beveled, so that every obstruction possible is removed.

Where for any reason lighting is obstructed, it is frequently necessary to increase the height of the ceiling. Although twelve and one-half feet is as high as the ordinary schoolroom should allow, it is better to sacrifice building costs and risk fatigue due to stair-climbing than to run the risk of eye-strain.

Calculating window space. In making calculations for unilateral lighting, it is fairly safe to allow three and a half feet for width of glass for each window and one foot for mullions between windows. In the ordinary school building such mullions must be made of steel if they are to support the weight which naturally falls upon them. A steel mullion of twelve inches will do the work which frequently required brick piers three or four feet thick. In small wooden structures of one story satisfactory twelve-inch mullions may be made of hard wood. The weight of walls above the window may also be caught and held by a steel beam or lintel combined with the narrow mullion.

Prism glass. Prism glass is an exceedingly useful agent for remaking old buildings so that lighting shall be increased. This glass is so made that instead of merely allowing rays to pass directly through it, rays which otherwise would be lost are caught and bent, so that the amount of light entering the room is materially increased. Certain forms of ribbed or corrugated glass, which are highly recommended for school purposes, should be avoided because of their tendency to reflect light in bright lines and so tire the eye. Care should be taken to secure a thoroughly satisfactory form of com-

mercial prism glass. When used in classroom windows, prism glass should be placed in the upper part of the windows. It is rather expensive, hard to keep clean because of its many ridges, and usually should not be installed until it has been made evident that remodeling the window or removing outside obstructions is out of the question. Prism glass is frequently useful for lighting dark hallways, toilets, basement playrooms, and wardrobes.

Overhead lighting. Very recently there have been erected, in different parts of the United States, one-story school buildings which are lighted from the top. Most of these have what is known as "saw-tooth lighting," that is, the roof is made in lengthwise sections, each section shaped like a saw tooth, with one side slanting and the other vertical. The vertical side is made of glass. Saw-tooth lighting is largely used in factory buildings, because it has been found most satisfactory where careful handwork is being carried on. All parts of the room are lighted equally well, and there are no disturbing shadows.

For school purposes, there seem to be four objections most commonly raised against overhead lighting of this type. In the first place, it is claimed that the sensation of being confined by four solid walls, without opportunity to see what is going on outside, is distinctly unpleasant. To obviate this difficulty some architects insert a glass paneled door or window on one side, with a curtain which can be drawn at will whenever the side light interferes with work.

The second objection is that many of these buildings are supplied only with north light, and direct rays of the sun never enter. This is such an exceedingly serious defect in schoolhouse construction that active measures should be taken for the frequent admission of direct rays, either by placing the glass so that sunlight will be admitted before or after school hours (as, for example, by installing windows

facing west for morning classes), or else by providing special sun windows which are kept dark when classes are in session.

The third difficulty encountered with overhead lighting is that the light is too strong, or filled with bright streaks, which cause eye-strain. Such a condition may arise from errors in location or installation, such as having the glass face toward the sunny side. Translucent and opaque shades may sometimes be needed, much as they are used in the photographer's studio, to cut off portions of the light. Sometimes a second sheet of glass is installed in the ceiling, which helps to catch and diffuse the light.

In the fourth place, where buildings are in exposed locations, care must be taken to turn the windows away from prevailing winter winds, because otherwise they may be covered with curtains of snow or ice which are difficult to clear away. It is important that the roofs be easy of access, so that windows may easily be kept clear and clean.

Window shades. The schoolroom shade is used to exclude direct rays of the sun; only rarely — as, for example, when stereopticon lectures are being given — should it be used to exclude ordinary sunlight. Therefore the opaque shade of green or black commonly used in schoolrooms is distinctly an unwise choice unless a light-colored shade is also installed. When annoying rays enter the room and shades are lowered say two and a half feet to cut them off, if the shades are opaque the amount of light received by desks on the farther side is very nearly cut in half. Mr. Rowe, who was one of the pioneers in studying schoolroom lighting, suggests shirting, ecru, or light cream-colored twilling for shades, and states that he has had even more satisfactory results in his experiments with light sage color, which is dark enough to please the eye, but light enough to provide good schoolroom illumination. Care should be taken to select shades which are at least two inches wider than the space they are to

cover. If narrower widths are used, the shade as it stirs in the wind allows long streaks of sunlight to appear at one side or the other, and is frequently a source of great annoyance for which no remedy can be found.

It is of prime importance, also, that some scheme be devised whereby any portion of the window may be shaded without necessarily covering the portions below or above. If shades are fixed at the top, as is usually the case, in order to cut off glare from the row of desks nearest the window, the entire glass area must often be covered, and the desks at the farther side of the room are unnecessarily deprived of light. Exactly the opposite thing happens when shades are fixed at the bottom. It is frequently suggested that the better way is to fasten two rollers, about two fifths of the way up, and arrange one to shade the upper part of the window and the other the lower. Where this is done there is frequently difficulty because of a narrow slit, which allows a bright ray of sunlight to enter between the two rollers. One suggestion for remedying such a difficulty is to place the rollers so that the upper pulls toward the bottom of the window and the lower pulls toward the top. Probably the most satisfactory arrangement for window shades is the adjustable shade which has but recently been put upon the market. The roller can be fastened at any point on the casing by a very simple mechanism, and the shade raised or lowered so as to cover any desired portion of the glass.

Any shade which is to be used by the average schoolroom teacher must be of exceedingly simple construction. Few women have had the training or experience in solving mechanical problems which come almost inevitably into the life of every boy. It would be well if all normal schools established classes in school hygiene which would include training in the principles and operation of simple heating, ventilating, cleaning, and lighting devices, so that teachers

would not find themselves helpless before minor accidents to schoolroom equipment. Teachers should not only know how to untangle curtain cords, replace them on pulleys, and tighten the spring in the old-fashioned curtain roller, but they should have some knowledge of the principles of lighting and should know how and when the curtains should be used.

Wooden shutters, Venetian blinds, folding wooden blinds, and the like, should on no account be placed at a schoolroom window. They gather dust, seriously darken the room, get out of order, cut off breezes, and frequently allow narrow bars of sunlight to stream across the floor and irritate the eyes of the pupils.

Color schemes. As part of the many experiments in schoolroom lighting, color schemes have been worked out for walls and ceiling which are restful to the eye and yet do not absorb light. The plan adopted for the schools of Cleveland is typical of the more advanced practice. In Cleveland the colors used in classrooms have been carefully worked out and standardized. Wood is of dark dull finish, ceilings just off white, walls creamy gray, dados French gray. Rooms with north light have a little more color mixed with the gray than rooms with south light.[1] Blackboards are of the natural dark slate color. Desks and chairs are of a brownish dull stain which does not reflect light. In other cities buff is frequently used instead of gray; or the gray is mixed with just enough green to give it an olive tone. Reds, oranges, and browns should never be used, although a pale shade of tan is permissible.

Lighting in old buildings. If the lighting of an old building is poor the following suggestions will probably be helpful: —

[1] It will be noted that in the opinion of the authors of the present work no classrooms should be planned to face north or south. Successful architects can be found, however, who claim that north light is by far the more restful and should be utilized for study purposes.

a. First, wash the windows. In many buildings it will be found that an astonishing difference is made in the amount of light admitted to schoolrooms by the simple expedient of cleaning windows more frequently. Dust and smoke gather on the outer surface of the glass and form a curtain which effectually bars out entering light rays. In cities where the air is very dirty, it may be necessary to double or treble the frequency with which windows are washed.

b. Investigate to see whether there are obstructions outside the window, such as hills, trees, or office buildings. In some cases such obstructions may be removed.

c. Measure the amount of glass area and compare it with floor area. Such measurement does not make any change in the conditions found, but frequently changes the attitude of mind of the persons making the study.

d. See whether windows may be raised at the top. Round or arched windows may often be made square. Sometimes ornamental semi-circles or transoms have been placed above each window, and when these are replaced by squares of plain glass the light area is measurably increased. Occasionally an extra window may be added, or the wide piers between windows replaced by narrow metal mullions, and the additional area filled with glass.

e. Notice from what direction the light comes. Are there windows at the front? at the right? the left? the back? If light enters from all four sides, the windows at the front and right can usually be covered with opaque shades or filled in entirely with blackboards. Occasionally the entire left side can be remodeled so that it is practically one huge window, and the extra windows of the other three sides filled in. Sometimes lighting can be improved simply by changing the direction in which the children face. Very little can be done to improve conditions in rooms lighted solely from the north or from the south, although in the latter case some help may

come from experimenting with different types of window shades.

f. When windows are equipped with wooden blinds, opaque shades, or the like, see that these are replaced by new shades of approved construction and color. Remove the old-style shades whch are attached at top or bottom, and substitute the combination up-and-down shades, or, better still, the new type of adjustable roller which can be made fast at any point of the window frame.

g. If windows are placed too near the floor, cover the lower panes with opaque shades. Again, if windows are too near the blackboard at the front, keep the curtain drawn on all bright days.

h. Remove all blackboards which are placed between windows.

i. Sometimes a dark room may be made lighter by repainting the walls a lighter tint, or by placing curtains on rollers above each blackboard and keeping them drawn except when the boards are actually in use.

j. Rooms may often be given a better diffused light by substituting a good quality of prism glass for plain glass at the top of the window.

k. Occasionally it is wise to introduce glass panels into classroom partitions, or doors. The cases where this is justifiable are, however, few in number, because the practice usually results in cross-lights, or patches of light and shadow. Door panels are less objectionable than wall panels, especially when they open into rather dark halls. Care should be taken to avoid glare through such panels, such as might be cast by a hall window or lighted court.

l. If, in spite of various efforts, the lighting of the classroom continues to be insufficient, the desks farthest from the windows should be abandoned and actually removed from the room, so that there will be no temptation to use them.

If the other desks are insufficiently illuminated, the room should either be abandoned or equipped with artificial lights and used for some school purpose other than regular classes.

2. Artificial lighting

Recent use of light at night. It is not until very recently that city schools have begun to be used at night. Since early times the country school has been the center of many community activities. Religious services were often held there, frequently the schoolhouse was used for committee conferences or town meetings, while spelling-bees and singing-school were among the important social events of the winter. Most of these meetings were held in the evening, and many people who were educated in the country school still have vivid memories of the closely packed room, with every bench filled, and rows of small boys along the window ledges. Heat was furnished — sometimes far too vigorously — by the wood stove in the center of the room, and high on each wall swung an iron bracket holding a kerosene-oil lamp, with its tin reflector, shedding a dim yellow light over the company.

Within the past decade there has sprung up a movement which aims to make all school buildings, whether in city or country, available for public purposes, and increasingly we find them open and brightly lighted for evening classes, clubs, athletic contests, dances, concerts, lectures, and dramatic presentations. The movement which has as its slogan, "Wider use of the school plant," has instituted many significant changes in school architecture. One of these is the emphasis which it has laid upon the necessity for adequate artificial lighting. City school buildings were sometimes lighted even before this time, but usually the work was poorly done, and had as its main purpose the supplementing of window lighting on rainy days. Now lighting plans are

carefully drafted by an illuminating engineer, and an attempt is made to forecast possible needs of the future, and to render each room a comfortable, well-lighted workshop by night as well as by day.

Direct glare. In planning artificial illuminating several dangers should be kept in mind. In the first place, care should be taken to prevent direct rays of light from entering the eye. Probably all of us have attended public lectures in halls where clusters of unshaded electric lights hung from the ceiling above the speaker's head, or branched out from supporting pillars directly in our line of vision. One such evening should be sufficient to convert the most doubtful superintendent or school board member to the necessity for carefully shaded and well-placed lighting in the public building. There is no excuse for permitting direct glare in the schoolroom.

Lamps should be placed so that their light falls from above the line of vision, and somewhat to the left: that is, no lamp should extend below an imaginary line drawn from the eye of the pupil in the back row of seats to a point about two feet above the blackboard, and all fixtures should be so located that they shine to the left of the pupils, and so avoid casting shadow of head and shoulders upon the desk.

Indirect glare. In the second place, indirect glare should be avoided. Shiny blackboards, polished woods, glossy paint, framed pictures, maps, and the like, tend to reflect light into the eyes of the pupil, and frequently cause discomfort or even severe headache. It is a safe rule in schoolroom furnishing to avoid all glossy surfaces. Desks should receive a dull finish. Walls should be slightly roughened or covered with dull paint. Where highly polished surfaces cannot be avoided, as is sometimes the case with maps or blackboards, special pains should be taken to prevent reflections from lamps by careful placing and shading.

Flickering. Flickering light is exceedingly annoying, and is also a common cause of eye-strain. Most people find that reading for several hours at a stretch while on a railroad journey results in a severe headache, although reading the same length of time at home produces no noticeable fatigue. One of the reasons is that, due to the motion of the car over its not too even roadbed, both book and light are constantly shifting, and as the eye seeks to adapt itself to these continuous quick changes the muscles quickly tire. Similar trouble is found by the hunter who seeks to write letters at the open camp-fire, or the small boy who peruses his forbidden novel in the top loft of the barn by the aid of a flickering candle. The lamps selected for schoolroom use must be supplied with a steady amount of current or fuel; open flames must be protected from draughts; and fixtures should be so installed that they are unaffected by sudden jars or vibrations.

Intensity. Care should be taken not to provide lighting of too great intensity. It is curiously true that most people feel uncomfortable unless they are supplied with considerably more light than is actually necessary in order to work well. It is usually possible in such cases to compromise by supplying over-illumination for small areas directly over the work-table, but being careful not to plunge the whole room into intense light.

Shadows. Shadows on desk surfaces are undesirable, because they make it difficult for pupils to see their work. For this reason we often find the statement that all shadows should be eliminated from the artificially lighted classroom. As opposed to this theory we have the fact that it is actually restful to the eye to have somewhat less light reflected from surrounding surfaces than from the work area itself. For example, it is more restful to read a book while seated at a table covered with a dark green cloth than to read at the

same table when it is prepared for a meal and covered with smoothly laundered white damask. In the first instance, most of the light reflected into the eye comes from the pages of the book; in the second, light is pouring up from the entire table area, and the eye muscles seek to accommodate themselves to two diverse sets of stimuli. Where, instead of the green cloth with its low reflecting power, we have an area of shadow, the restful effect is the same, and for the same reason. One cause of the popularity of the student lamp is that it gives a high light within a narrow area, and leaves the rest of the room in comfortable semi-darkness, so that the eye is freed from outside stimuli.

We may properly say that whatever surfaces are to engage the attention of the pupil should be free from shadows within the area of attention: that is, the front blackboard at which all children look must be treated as a unit, because the writing or drawing for a single lesson may cover the entire area. When this is the case any shadows falling upon the blackboard will interfere with ease in reading, and care must be taken to see that the illumination is spread evenly over the entire surface.

Contrasts. As a corollary of the preceding discussion it becomes evident that sharp contrasts must be avoided wherever possible within the attention area. Many sharp contrasts, such as white chalk on black slate, black ink on white paper, and the like, are necessary for the conduct of our classes. It is all the more essential, therefore, that sharp contrasts which are not necessary be most carefully eliminated. For example, glistening white maps should be rolled up during the arithmetic lesson. Bookracks, calendars, and inkwells of polished brass should either be removed from the teacher's desk or hidden from the sight of the pupils. Exhibits of children's work, in the form of drawings, paper-cutting, or compositions, should not be

placed along the front blackboard, because they form too sharp a contrast to the board beneath. If they are placed along the side or back of the room, they can be examined from time to time without being constantly faced and thus contributing to eye-strain.

Care should also be taken to remove from the walls, floor, and ceiling any surfaces which tend to distract the eye. Any bright object on the edge of the field of vision may cause uneasiness by stimulating the eye unduly. A shiny metal fixture on the window curtain slightly behind his shoulder may cause the reader to start with the unpleasant sensation of something about to strike him or fall upon him. The brain is peculiarly alert to give warning of bright or moving objects, and if attention is to be concentrated upon a given work area all diverting stimuli outside this field should be avoided.

Kerosene. There are many people who feel that the old-fashioned kerosene-oil lamp is superior to any other form of lighting. They admit that it is a nuisance to clean and fill, that it gives out large amounts of heat, is apt to smoke, and is a frequent cause of serious fires; but they claim that in spite of all these disadvantages it retains superiority because of its soft yellow light which is pleasant and restful to work by and does not strain the eye muscles. It is probably true that the oil flame is much less trying than unshaded gas or electric light, but there is no excuse for providing unshaded or undiffused light of any sort, and the dangers of kerosene lighting are so numerous that it should be prohibited for public buildings.

The kerosene-oil lamp gives out a great deal of heat, and uses up large amounts of oxygen. People who habitually use this method of lighting are so accustomed to it that they are hardly aware of its evil effects. City people, however, who return to the old homestead for the Christmas holidays,

and are given a portable oil heater to warm their bedrooms into some semblance of steam-heated apartments, find that, although the heat pours out with incredible rapidity, the air soon becomes so stifling that if headaches are to be avoided windows must be thrown open and fresh supplies of frosty air allowed to enter. Even with windows open the room is filled with the peculiar odor of burning kerosene, and not infrequently the flame climbs higher and higher until, with scarcely any warning, a dense column of black smoke pours upwards toward the ceiling. The stove rarely does explode, but it always looks as if it were going to. Oil lamps are fully as dangerous as oil heaters; they have long ago been discarded in city schools, and should no longer be tolerated in school buildings of rural communities.

The increased number of electric companies with their radiating interurban lines afford electric light to up-to-date farmers, and many schoolhouses could be connected with such circuits. Many parts of the country have local supplies of natural gas which could be used in the rural school; and when neither gas nor electricity is available the acetylene arc lamp will be found markedly superior to the kerosene flame.

Acetylene gas. Acetylene gas is produced by bringing calcium carbide in contact with water, and thus liberating the carbon which joins with the hydrogen of the water and forms gas. One pound of calcium carbide yields about five cubic feet of gas. The light given off by an acetylene lamp is nearer the quality of sunlight than any other artificial illuminant. The human eye has been adapting itself to sunlight for many thousands of years, and naturally can do its work better in a sunlit room than in any other. Illuminating engineers, knowing this, have long sought to procure some form of artificial illumination which should approach in color and quality the sun's rays; and, while they are not

yet satisfied, they have found that acetylene gas comes nearer to meeting this demand than any other artificial light.

The illuminating power of acetylene is ten times that of city gas. A. C. Morrison, in the *Scientific American*, says: "Reduced to practical figures, a half-foot burner supplied by acetylene will give greater illumination than a five-foot burner supplied by city gas." The cost is not excessive. A plant with a fifty-light capacity can be installed for two hundred dollars. The carbide can be otained at about four cents a pound. One pound of calcium carbide yields about five cubic feet of gas, so that one thousand cubic feet of gas costs about eight dollars. In terms of illumination one thousand cubic feet of acetylene at eight dollars equals ten thousand cubic feet of city gas at eighty cents per one thousand cubic feet, which is, of course, cheap illumination.

Many people will hesitate about installing an acetylene plant on the ground that it is exceedingly dangerous. In fact there are certain districts where local regulations prohibit its use. As a matter of fact, great strides have been made since the days when acetylene generators were first placed on the market, and they have now been rendered so safe that the National Board of Fire Insurance Underwriters has drawn up regulations whereby plants may be installed in the basements of buildings carrying insurance, without increasing the rate.

Installing an acetylene plant. The generator must be cared for properly. Its care is less than that necessary for a kerosene lamp, its efficiency is much greater, and its use should always be insisted upon in lighting a schoolroom where gas and electricity are not available. In erecting the acetylene apparatus a solid foundation of brick, stone, concrete, or heavy timbers should be used. The machine must be set level, to obviate any strain on generator or connec-

tions. Each generator should be provided with an escape or relief pipe, not less than three quarters of an inch inside diameter, and carried outside the building to a point remote from the windows, and at least twelve feet above the ground. The opening of this pipe should be protected by a hood. Generators may be installed where running water is not available.

The machine should have a capacity sufficient to furnish gas continuously for a lighting period of at least five hours. The recharging of a generator is an operation which occupies on an average ten or fifteen minutes, according to the size of the generator and the number of lights. It can be conservatively estimated that a generator has to be recharged once in three to six weeks. In determining charges, lump carbide should be estimated as capable of producing about five cubic feet of gas per pound, and burners should be considered as requiring at least twenty-five per cent more than their rated consumption of gas.

No pet-cocks should be used in piping, and all piping should be arranged to drain any moisture back into the generator. The following schedule of piping is recommended: —

Three-eighths-inch pipe, twenty-six feet, three burners.
One-half-inch pipe, thirty feet, six burners.
Three-fourths-inch pipe, fifty feet, twenty burners.

All piping should be tested after installing.

We have gone at some length into the question of acetylene lighting, because where the acetylene system is used gas must be generated in or near the building, and the school authorities must be responsible for running the plant. Where gas or electricity are used most of the work of generating power, installing fixtures, and inspecting falls upon other shoulders than those of the school men.

Direct lighting. By direct lighting is meant that system

in which light rays are thrown directly upon the object to be illuminated. This is the most common form of lighting, and by many people is considered superior to the newer methods of semi-direct or indirect lighting. In direct lighting lamps should be above the oblique plane subtended from the eyes of the pupils in the back row to a horizontal line two feet above the top of the blackboard. Instead of being arranged in symmetrical rows down the center and halfway across the ceiling on each side, fixtures should be placed a foot or more to the left, so that the light falls more strongly from the left side of the room, and should be "staggered," which means placing lamps diagonally across from each other instead of directly opposite. Every fixture should be equipped with glass shades designed to secure wide diffusion of light and prevent glare.

Laboratories, art-rooms, and other rooms in which there is no need for group discussion, and where each member of the class works by himself, may frequently be lighted to good effect by drop lamps suspended above the desks. Where this is done the lamp should hang slightly to the left of the desk, and should be fitted with an opaque shade which will prevent the light shining into the eyes of other pupils. Electric bulbs used in drop lights should be frosted.

Indirect lighting. This plan throws the light upon a highly reflecting surface which diffuses it throughout the room. It effectually prevents direct rays from striking the eye. The lights are usually placed in an opaque bowl which is suspended from the ceiling. A reflecting surface is secured either by suspending a polished plate above the bowl or by painting the ceiling itself white, so that it casts down into the room the rays which are thrown against it from the lamps. Sometimes good effects are secured by placing rows of lights around the walls or in the ceiling in such a way that they are hidden from the eyes of those

Fig. 14. Indirect Artificial Lighting
(Permission Ex-Ray Reflector Company)

Fig. 15. Semi-Indirect Artificial Lighting

below by ornamental mouldings. This method is coming rapidly into favor for lighting school auditoriums.

There are many objections to be urged against indirect systems of illumination. For example, as was noted previously in the discussion of intensity and contrast, it is less tiring to work over an illuminated surface if the surrounding surfaces are somewhat darker than where the same intensity prevails. In many offices where approved systems of indirect lighting have been installed, it will be found — provided sufficient funds are at the disposal of the office workers — that desk after desk is provided with a supplementary portable desk-lamp because the indirect overhead illumination does not seem to the occupants sufficient for their needs. As a matter of fact, actual tests in most of these offices would show an ample number of foot candles in every part of the room. A possible explanation of the difficulty may be that the illumination of the working surface is sufficient, but the illumination of surrounding surfaces is too intense and is unrelieved by shadows. Normal sunlight casts shadows, and the eye has become accustomed to concentrate its attention upon the most highly illuminated areas, while relieved from equally intense stimuli without the area by shadows and varying colors. Indirect illumination gives the same intensity of light in all parts of the room, the absence of shadows is both wearying to the eye and possesses a somewhat weird appearance, and as a result the occupants are frequently uncomfortable. This curious physical and psychological effect is much less noticeable where people are talking or listening than in rooms where the occupants are busy with individual pieces of work requiring close use of the eyes. It is very probably true that indirect lighting will find its chief usefulness in illuminating churches, theaters, and auditoriums.

Semi-indirect lighting. It is here sought to secure the ad-

vantages of direct and indirect lighting and to avoid the disadvantages of each. Semi-indirect lighting is a plan whereby the lights are placed in a bowl and reflected from above, as in the indirect, but the bowl is made of translucent material, and some of the light shines through. In semi-indirect lighting shadows are more noticeable, and the effect seems somewhat more pleasant.

QUESTIONS FOR STUDY AND DISCUSSION

1. What sort of lighting is best for schools operated on the one-session plan?
2. What instruments are used for measuring light? Compare as to principle involved, simplicity, applicability to school conditions, cost.
3. How many foot candles are necessary for good illumination? Does this apply to all types of work? Should light be measured near window, at center of room, farthest corner? On bright day, average, or dark? Winter or summer? Why?
4. Does the location of windows on one, two, or three sides affect the rules for classroom width? How?
5. In one school system left and front lighting was chosen in preference to right and back. How would you undertake to argue this case?
6. Make a study of different types of windows; noting the advantages and disadvantages of each.
7. Visit school buildings on bright days and note the adjustment of window shades. How far does supplying the right sort of shade insure good lighting day by day in the classroom?
8. What are the more common methods of gas and electric lighting? Compare.
9. If plants are to be grown in classrooms, where should they be placed? Are window boxes or hanging plants the more desirable?
10. If you are not already familiar with the plan, visit any buildings (factories, schools, and the like) in your vicinity, which are equipped with overhead saw-tooth lighting. Note differences from ordinary side lighting.
11. How often should prism glass be cleaned? Why?
12. If acetylene gas gives so satisfactory a light, why is it not generally recommended for city school buildings?

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CHAPTER VI

WATER SUPPLY

Every school needs a bountiful supply of good water. City schools are obliged to depend upon the municipal water system, and if the water contains impurities schools can do little except complain to the authorities and arouse protests among doctors and parents. Practically no system of artificial filtration on the premises can be relied on to purify infected water; and in localities where the supply is dangerously bad, recourse must be had either to bottled water, brought from sources known to be pure, or to the regular city water boiled and afterwards chilled. For the large city school such a proceeding is well-nigh impossible, and the school lies at the mercy of the city authorities. Fortunately public health boards are now thoroughly awake to the perils of impure drinking-water, and most cities are under constant and careful supervision. It is the country children who are exposed to the most serious dangers of infection from this source.

Springs and wells. Most country schools obtain their supply of drinking-water from springs or wells on the premises, or on adjoining farms. All such water has originally fallen on the surface as rain or snow, gradually trickled down into the earth, and reached a pocket in the ground where it has accumulated in the form of a small underground stream. Where this stream breaks forth at a lower point of the earth's surface it is called a spring. Where it is tapped by digging or boring it is called a well. Springs are apt to find their water channels much nearer to the earth's surface than wells, and the chances that the surface water has been

thoroughly filtered are correspondingly less. Springs which are near swampy ground are very frequently contaminated. Whenever they are in low places near barnyards or pastures the chances are large that the water will be heavily laden with particles of decomposing manure and other farmyard waste.

Where springs have their outlet in open pools it will be found that, unless great care is taken to prevent animals and human beings from making free with the water, the pool becomes quickly laden with impurities. In the same way wells sometimes receive the greater part of their water from the drainings of privies, barnyards, and the like. There seems to be a tendency among country people to feel that water which comes up out of the earth must be purer than that which flows upon its surface. Sometimes they are right; but frequently they are perilously wrong. The quality of water in spring and well depends largely upon the geological formation of the ground around it. For example, sandy loam permits of free ventilation and acts as a natural filter, but clay or rock is like a huge drain pipe which conserves all the impurities of the water, and may carry them for miles. In planning where to sink a well, therefore, it is necessary to learn something about the formation of the soil in that region. It is always safe to lay down the rule that no water shall be used which comes from a lower level than a barn, privy, or other contaminating agent. Observance of this rule will not insure clean water, but neglect will result in an impure water supply nine chances out of ten.

Carrying water by hand. Water may be brought to the school by pipes from a reservoir, by hand or machine pumps, or by being carried in pails. The rural school should never rely on having water fetched in small quantities, unless there is actually no other means of securing it. When this is unfortunately the case, large buckets should be secured, of gal-

vanized iron, with tops which can be fastened securely in place. Arrangements should be made with a responsible agent whereby these buckets are filled with fresh water daily and delivered at the school. On days when the school is not in session these buckets should be carefully cleaned and exposed to the full glare of the sun. It is important that the old method of sending two of the boys each morning with a wooden pail to the neighboring well for water should be abolished, for under such circumstances half the supply is spilled before the school is reached, the pails are uncovered and often dirty, and the water is frequently contaminated. With pails small enough so that they can be carried for some distance by the growing boy, the water rapidly becomes warm and uninviting; and, in addition, the supply is so small that children are usually discouraged from using it freely to wash their hands and faces.

The school well. A well on the school grounds is almost always preferable to a spring or to the offices of kindly neighbors. If due care is taken to locate the well properly, and to make it impervious to surface infiltration, the water can be kept sweet and pure throughout the summer months — when many claim school wells deteriorate because they are not being used — and a satisfactory water supply will be obtained for all school purposes. This means, however, that the well must be constructed with greater care than is usually exercised. A dug well can be made safe; but to do so is expensive, for it must be deep enough to reach below the line of surface infiltration, must be securely covered, and the casing made water-tight down to the lowest water-line. A driven well can usually be sunk much deeper, so that the opportunities for filtering water before it reaches the well are greater; and it is very easy to protect the sides from surface drainage. A driven well is frequently materially less expensive than a properly constructed dug well, and is, therefore,

to be preferred for school purposes. Sometimes a driven well may be bored through a hard layer of clay or rock, into a water-course sealed up below it. In such cases the source of the water is usually not near the school building, but may come from a spot several miles away. No matter whether the well be dug or driven, it must be remembered that if the water which supplies it comes from a contaminated source no skill in construction will render it safe. A good well conserves purity, but does not make it.

Every well should be covered at the top. There is something about the open well which is peculiarly tempting, and each child who passes feels the necessity of flinging down a stone or stick to hear it strike. Apple cores, rotten tomatoes, and even small dead animals find the uncovered well a handy receptacle; and every such offering adds to the impurity of the water. The well should be provided with a cement top which keeps out dirt and, when desirable, furnishes a platform for a force pump by which water may be drawn to the surface. A small pressure tank can easily be attached to the pump, so that water is always at hand for a bubbling fountain. Provision should also be made for carrying off the waste water by pipes so that it can neither flow back into the well nor dampen the surrounding earth, and so render it unfit to walk on.

Water pressure. It is exceedingly desirable that every school be supplied with water under pressure. City schools usually have no trouble here, but there are very few country schools which are so equipped. Water pressure makes possible indoor sanitary toilets, which are greatly needed in the country. It also provides plentiful opportunity for washing hands and faces, for keeping drinking-water fresh and cool, for use in cooking, and even for the shower bath which is coming to be a necessary part of rural-school equipment. In addition a bountiful water supply under pressure is one of

the safest provisions against fire. Every rural school not otherwise supplied with water under pressure should be provided with a tank or reservoir at a considerable height, to which water can be pumped by windmill, gasoline engine, or some other motive power, and from which pipes distribute the water, as needed, to various parts of the building. Another form, used in very cold countries, is what is known as the "Kewanee system," by means of which a galvanized iron tank is buried in the ground beneath the school building, and the water put into the tank under pressure by means of a gasoline engine, also in the basement of the school.

The individual cup. Seven years ago not a State in the Union had passed a legislative enactment against the common drinking-cup. To-day over half the States have laws or regulations against it, and more are added every year. Within half a decade we have seen the passing of the tin cup fastened by a chain in the railroad car, the depot, and the department store, and the introduction of the collapsible paper cup. At first the public schools sought to supplant the common drinking-cup by individual glasses, brought from home and labeled with the child's name; but it was speedily found that children have little fear of germs and are generous with their possessions, so that it was considered a mark of friendship to exchange cups. The paper cup, to be used once and then discarded, was fairly satisfactory, but involved some expense, and the discarded cups were apt to make an untidy appearance. Finally various types of bubbling fountains — previously used in parks and outdoor playgrounds — were adapted to school uses. Now the bubbling fountain has become a standard piece of schoolhouse equipment.

Bubbling fountains. In large schools a fountain should be placed on each floor of the building, in the basement,

and in the playground. Playground fountains should be disconnected during freezing weather. There should be at least one fountain installed for every seventy children in attendance, and a better standard is one for every forty children. The bubbling fountain should present a stream two inches high, and be so arranged that waste water is carried off without mixing with the fresh. It should be protected by a frame which prevents the mouth from coming in contact with the outlet, but care should be taken to make this frame in such a way that children will not run any danger of breaking their teeth upon it. There is something so peculiarly helpless in the appearance of another person bending over a drinking fountain that most normal children, and some adults, are filled with a sudden strong desire to push the drinker's head down into the water. If the fountain is not designed to protect the child against just such accidents painful injuries may sometimes result.

Another tendency against which precautions should be taken is that which children have of covering up several holes in a battery of fountains in order to concentrate water pressure on one, and so produce a high forceful stream. If such a result can be produced at the moment when a companion is bending over in the act of drinking the victim is sure to receive a drenching. Most of the newer fountains are so arranged that any such manipulation of water is out of the question.

The fountain should be made of porcelain, nickel, or some other substance which is well protected against rust or corrosion; and should be simple in design, so that it will not get out of order. The key which turns on the water should be plainly visible and easy in action, so that children can work it without having to use both hands. Some simple device should be attached for regulating the size of the stream. The pipe which carries off waste water should

be so arranged that it will not readily become clogged with paper, twine, or other refuse.

Home-made fountains. Dr. Dresslar suggests that in schools where the standard manufactured bubbling fountains seem too expensive, it is possible to make a fairly good substitute by connecting the main service pipe, at the middle point of a horizontal length of nickel-covered water pipe, and closing both ends. Small holes should then be pierced, about thirty inches apart, along the length of this pipe, each slightly toward the front so that a stream of water passing through would not fall back into its own hole. A key should control the stream. Below the bubblers should be placed a sink or basin to carry away the waste water. These bubblers bring the children rather close together, so that disturbances are likely to follow, and they are so constructed that water may be squirted in long streams by manipulating the openings. Moreover, there is no means of insuring that children will not place their mouths directly in contact with the pipe. The fountains so constructed are distinctly inferior to many designs on the market, and should only be installed where others cannot be procured.

Cooler attachments. For rural schools without water pressure, bubbling fountains may be secured to fit on small tanks or coolers. The rules covering their construction are the same as those for pressure systems; except that while in the latter cases fountains are allowed to run all the time during certain periods, — for example, at recess, — where the supply of water is limited as in the former case, the fountain should close automatically as soon as the child finishes drinking.

Height of fountains. A common fault in installing drinking-fountains is to make them either too high or too low. Primary children sometimes have to be lifted up in order to drink, while tall high-school students are made to feel unnecessarily awkward by fountains which would be just the

right height for their little brothers or sisters. A series of simple experiments is needed to determine standards for heights of fountains, such as have already been determined for the placing of blackboards.

The habit of cleanliness. Space is given in the next chapter to the reasons why facilities for washing the hands should be provided in connection with every toilet-room. The habit of cleanliness can only be established through giving children a clear understanding of why it is desirable, and then seeing to it that washing actually takes place. Mere supervision and enforcement of the rule will be of comparatively little value unless it is connected with a hygienic attitude of mind; and one of the most important tasks of the health department in the public school system is to establish such an attitude through careful and effective teaching. As an aid to such teaching, every school should be provided with equipment so that lessons learned may be put into practice.

Lavatories. Few definite standards have as yet been evolved concerning the number and location of lavatories. Children's hands become dirty while on the playground, while using chalk at the blackboard, handling books, writing with ink, working in the shops or gymnasium, and the like. They should be encouraged to wash their hands whenever they are dirty, and if they are to eat lunch at school washing the hands before entering the lunchroom should be insisted upon. If such a plan is to be carried out, however, it becomes essential that adequate washing facilities be provided and situated where they may be reached quickly, so that children will feel free to use them and time will not be lost away from the classroom. While most school men are theoretically in agreement with this principle, actually there are few schools in the United States built and equipped in such a manner that it can readily be put into practice.

In many schools the only washing facilities are in the basement. Wash-basins are certainly needed both for children coming from the toilet and for those on the playground; but if the only washbowls are in the basement children will rarely use them for removing the dirt of the classroom. In some parts of England and the United States wash-basins with hot water are placed in every dressing-room. More frequently in this country they are placed on each floor in the hallway, or in a small room set aside for that purpose. The second method makes for simpler plumbing, but probably means that water will be used less freely. In a few cases wash-basins are supplied as part of the regular room furnishings. It is fairly common for special washing arrangements to be provided for children in the open-air classes, so that they may wash the hands before eating, but there is rarely any similar provision for normal children who patronize the school lunch, even though the practice of eating with dirty hands is widespread and distinctly dangerous.

Wash-basins should always be installed in rooms where special cleanliness is desired — such as sewing-rooms, or where dirty work is being carried on, as, for instance, in forge-rooms, printing-rooms, gymnasiums, and the like. They should also be part of the equipment of the doctor's office, teacher's rest-room, and kindergarten. In England, according to Burgerstein's account, one wash-basin is provided for every twenty-five children. In the United States each basin is frequently expected to accommodate several hundred children. The installation of a basin in every dressing-room, or a washroom with a battery of basins on every floor, would involve heavy expense, but the returns in improved health and better habits would speedily justify the investment.

Hot water. Lavatories should be supplied with hot water

as well as cold. This at once implies some means of heating water in connection with the regular heating-plant. Cold water is better than none, but it is ineffective in removing dirt, and in winter children will often refrain from washing at all rather than plunge the hands into very cold water.

Soap. A good quality of liquid or powdered soap, in containers devised to prevent spilling and waste, should be provided over every basin. Soap may be brought from home by individual children, but the cakes are apt to get lost, be lent from one child to another, fall on the floor, and generally prove unsatisfactory. Care should be taken in selecting liquid soap to choose a brand which will not irritate the skin.

Towels. Individual towels may be brought from home by the children or may be supplied by the school. In the latter case they should be thoroughly washed and sterilized before being given to new children. Some schools supply each child with a fresh towel once a week, and have strict rules against exchanging towels between friends. Paper towels which are used once and then destroyed are rapidly coming into use. When first introduced they were rather expensive, but the price is coming within the reach of school boards; and it is probable that before long they will have largely supplanted cotton or linen towels. Large bins should be provided for catching the discarded paper towels, because, since they are rather bulky, they rapidly litter the floor and evoke bitter complaints from the janitor.

Baths as punishments. Bathing is such a primitive need of the body that increased facilities for its performance mean always increased health. It is rather astonishing that such slow progress has been made in the United States in providing baths for school children. A few cities supply showers or pools in their newer buildings, but rarely are there fixtures enough to provide frequent baths for all

or even most of the children enrolled. In many places the school bath is regarded as something rather like a disciplinary measure. The teacher inspects the children, and upon detecting evidences of uncleanliness orders the culprit to the showers; so that the idea of bathing is forcibly linked in the minds of the pupils with the idea of punishment. Few better methods could be devised for making children wish to remain unclean.

Group showers. The school showers should be regarded as one of the most important and delightful of school possessions. The children should be made to feel that bathing is a privilege, and that they are more fortunate than the pupils in less modern buildings who have to do without. Bathing-rooms should be made as attractive as possible, well ventilated and flooded with sunlight, and large enough to accommodate entire classes at one time. The cheapest form of sanitary shower is the German type, in which fixtures are placed above large pools of water about a foot deep, which are built in the cement floor. Children are turned into these pools in groups of twenty or thirty, are supplied with cakes of soap, and after they have carried on a preliminary scrubbing with the water already in the pool the showers overhead give them a thorough rinsing. The pool water is warm; the showers are warm, gradually turning to cold. When girls bathe in this way their hair should be protected by rubber caps, or by towels worn turban fashion.

Another form of the group shower does away with the scrubbing-pools, and merely has the children stand on a cement floor, which slopes toward drains at the center. If the cement floor becomes slippery it is often necessary to provide a flooring of wooden slats in order to prevent falling. In most cases the group shower can be used successfully with boys, but is not advisable for girls. Even with the younger girls parents are usually so averse to the idea of

group bathing that school people will find that any such suggestion arouses strong opposition. Showers for girls should be placed in booths or separated from the rest of the room by curtains. Fixtures should be so adjusted that the spray is shot from the side, rather than from above. It is very difficult to prevent girls' hair from getting wet in an overhead shower, and such an arrangement is sure to be unpopular.

Dressing-rooms. Where the system of ventilation is such that steam is rapidly carried away, dressing-rooms should be built close to the showers; but where the air is damp the outdoor clothing sometimes becomes filled with moisture, and serious colds may result. Where dressing-rooms are at a distance from the showers, sheets should be provided for girls to wrap about themselves while walking back and forth. A simple arrangement of dressing-booths and shower is installed in several of the Cleveland schools, where one shower and four booths, each furnished with a seat, are designed to form a complete square.

Rural bathing. Some form of shower bath should be installed in every school and in sufficient numbers to provide for every child in the building a bath every week. In rural schools supplied with water under pressure baths may readily be installed, and hot water secured by a hot-water tank connected with furnace, stove, or separate heater. Even without a pressure tank water may be pumped by hand into an overhead reservoir with shower connection. One of the reasons why the country child makes such a poor showing in the medical inspection reports is, that in many districts country people regard bathing as an unnecessary luxury intended for babies, invalids, and summer visitors. Many respectable city dwellers, who are rendered wretchedly uncomfortable without the daily bath, spent their early days on farms where the only reason for washing was to remove

dirt from face, hands, and neck, — the parts of the body which showed, — because with them and their neighbors cleanliness was a matter of looks, and had little to do with good health.

In the ordinary farmhouse, where water is pumped from the well and heated in tea-kettle and boiler on top of the kitchen stove, it is a serious undertaking to provide baths for a large family. The city dweller himself would find that if the family washtubs had to be carried into the kitchen and filled and emptied by hand, even a weekly bath would tend to disappear. There is no need for the farmhouse to be lacking, as it so often is, in the simple sanitary equipment which makes for cleanly living, but years of education must ensue before the farmer desires cleanliness enough to work for it, and pending that time the country school must care for the bathing needs of its children.

Tubs and pools. It is unwise to install tubs in school buildings or other places of public resort because, to make them safe, requires sterilization after each use; they take up too much room; are expensive to purchase; and are less refreshing than the shower bath. If soap is provided, dirt may be removed under the shower as easily as in the tub.

Many high schools and a few elementary schools in the United States are equipped with swimming-pools. They should not be used for purposes of cleaning the body; in fact, shower baths should be supplied and their use insisted upon before swimmers are allowed to enter the water. The pool is of value chiefly because it provides good sport, practice in group activity, physical exercise, and opportunity to learn how to swim. From the educational viewpoint the swimming-pool is a good investment.

Construction of pools. The location chosen is usually in the basement, on the south or east side where good lighting can be secured. The pool should be about seventy-five feet long (so as to provide for the twenty-five-yard dash) and

twenty or twenty-five feet wide. The depth varies for different uses, but should be at least seven feet at one end and two and one-half feet at the other. The bed and retaining walls should be of concrete, lined with asphalt, and provided with an inner lining of cement or brick, with wall ties to bind the enameled brick facing. This interior facing should be glazed, without cracks or roughness, and set with rounded corners, so that it can be kept scrupulously clean. A light-colored surface makes for cleanliness, and is the best background for the black lines which should run the length of the pool, on the bottom, for guidance in speed swimming. Square ends are necessary if swimming meets are to be held.

A life rail should be set level on the top course of brick, and a scum trough placed below, just at the water level. The waves made by the swimmers will then carry scum formed into the drain pipe. In some pools cuspidor attachment is made with the life rail. Swimming often causes one to raise mucus, and if cuspidor is not at hand the swimmer will expectorate and so defile the water. At each end of the pool steps should be built into the side wall to take the place of the ladder usually placed there. The depth of the water should be clearly marked on the sides and bottom. A springboard and a diving-stand are desirable additions to the equipment of the pool.

Keeping the water pure. Objections are frequently raised to public swimming-pools because of the danger of infection resulting from many persons bathing together in polluted water. That the fear is justified is shown by experiments such as those quoted by Bunker and Whipple. "It was found that washing a dirty male hospital patient yielded twenty-five thousand million bacteria; that a smooth-skinned 'clean' man gave three thousand million, as against fourteen thousand million from a hairy-skinned individual. The feet of a boy in the corridor, about to enter the pool, yielded eighty million."

When swimming-pools were first introduced there was grave fear of transmitting disease, and many experiments were carried on to find means of overcoming the danger. As a result, it has been found that pools may be made safe by a combination of refiltration and doses of hypochlorite of lime. Arthur N. Crane, in the *Proceedings of the American Association for Promoting Hygienic and Public Baths* says, in discussing refiltration: "However, it is only fair to point out that while many of the reports from pools where refiltration only is employed indicate high bacteriological efficiency, this cannot reasonably be expected so confidently as if the hypochlorite of lime treatment also were used. While it is quite possible to operate a mechanical filter so as to deliver at the outlet of the filter a water pure to the degree demanded by health authorities for drinking-water, and a pool could therefore be filled with pure water, yet the first individual entering it would contaminate it, and while the filter could always be operated so that the water would always be pure, the full effect of this would be lost so soon as the water mixed with other water in the pool which had already been contaminated." He goes on to explain the desirability of the hypochlorite of lime treatment. Ordinary commercial hypochlorite of lime contains about thirty per cent of available chlorine. It is this nascent chlorine which acts to kill the bacteria. One pound of the hypochlorite will treat satisfactorily a one hundred thousand gallon pool, and since the lime only costs two cents per pound the annual bill for this preventive will be only about $7.30.

Refiltration is even less expensive. Reports show that it takes on an average two tons of coal to heat a one hundred thousand gallon pool to a temperature of between 70° and 75° F. In addition, water itself in most communities is rather expensive. If this water is used over and over again, freshly filtered each time, — and never allowed to lose much

of its heat, the result is a decided money-saving. Refiltration, combined with dosing of hypochlorite of lime, procures a constant supply of fresh water emptying into the pool, and a continuous purification of the water already contained there, so that dangers of infection are reduced to a minimum.

Rules and regulations for pools. In boys' and men's pools no clothing, or at most nothing more than a pair of bathing-trunks, should be worn. A cleansing shower of hot water and soap should always precede the plunge. In girls' and women's pools the clothing should be a single-piece swimming-suit, similar to men's trunks and jerseys; it should be sterilized after each using and kept in the building by attendants. Girls and women should be obliged to remove suits and hang them over the door before taking the cleansing shower. The following rules and regulations will be found needful in the administration of swimming-pools: —

1. Maintain the water in the pool pure and clear by employing refiltration and hypochlorite of lime.
2. Have the pool well lighted by sunlight during the day, and by artificial lights at night.
3. Have an attendant always on duty when the pool is in use; grant no admission at other times.
4. Prevent persons with any communicable disease from using the pool. Examine the heart of every person admitted.
5. Enforce the cleansing of each bather before entering pool. This may be accomplished by: —
   a. Admittance to pool only through showers.
   b. Insistence that suits be taken off and thrown over door while women bathe.
6. Allow no unsterilized clothing to be worn in the pool. Guard against stockings and undergarments worn under bathing-suits. Insist that all women bathers shall wear rubber caps.
7. Provide a scum gutter around the pool; prohibit expectoration in the pool.
8. Prevent visitors from walking around the pools, and thus tracking in dirt. Visitors must stay in the gallery.
9. Prohibit handkerchiefs in the water; allow no cold cream or

powder to be put on the face before entering; prevent bathers with cuts, vaccinations, corn plasters, or bandages from using the pool.

10. Have a long pole on either side of the pool with which to help persons unable to swim who go beyond their depth.
11. Do not have any obstruction in the pool or along the edge. Do not allow running on the tile approach to the life rail.

QUESTIONS FOR STUDY AND DISCUSSION

1. How should rural-school authorities determine the geological formation of ground around the school building? Are any government sources of information available?
2. When is water considered "pure" for drinking purposes? How may it be tested? Are any of these tests practicable for use by teachers?
3. What is a driven well? A dug well? What are the advantages and disadvantages of each?
4. Make a comparative study of drinking fountains now on the market; noting such points as durability, simplicity, safety, economy of water, cost, and the like.
5. Secure a table showing height of school children at different ages, and from this determine how high drinking-fountains should be made for various types of schools. Should all the fountains in one building be of the same height?

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CHAPTER VII

TOILETS

Typical toilet-rooms. The following paragraphs, taken from the volume on *School Buildings and Equipment* of the Cleveland Education Survey, is a fairly accurate description of the toilet-rooms in most city school buildings: —

The typical toilet-room in the elementary school is located in the basement. Walls are whitewashed and the floor is of cement. The room is lighted from one or two sides by several small windows near the ceiling. Down the center of the room runs a double row of toilets, placed back to back, and separated from each other by wooden partitions. Except in the newest schools there are no doors or screens to shield the occupants, either boys or girls. Toilets are of the latrine type — that is, they all empty into one large trough running underneath, and are flushed at regular intervals by a central flushing system. The body of the toilet is usually of iron, and the seat of wood with a wooden cover. All seats are the same height from the floor, without regard to the size of the children for whom they are intended.

In the boys' room urinals of metal covered with white enamel paint and supplied with iron bases are placed around the sides of the room. They are continually flushed by overflow or pierced pipes at the top, and are open to the room without dividing partitions or screens. In over half the schools metal urinals have been replaced by porcelain, with glass bases of the same shape and flushed in the same way. Where metal urinals are used there is sometimes an unpleasant odor. Cement floors around latrines and urinals are usually discolored.

Toilet-rooms receive little light from outside windows. Where latrines are ranged down the center of the room they cut off all sunlight and render the rooms so dark that artificial lighting is constantly necessary. In old buildings there are very few toilet-rooms in which the sunlight ever reaches the farthest corner.

At one side of the room, against the wall, or else just outside the door, are placed at least one, and often four, sanitary drinking-

fountains, and beside them four wash-basins with hot and cold water. In a few cases shower baths are also located in the toilet-room.

Doors are of wood and frosted glass. They are in two parts, with a post between. One side swings out, and the other in. All rooms are labeled. The boys' room is usually at the opposite end of the building from that of the girls. Throughout the schools these rooms are exceptionally free from obscene writing.

The Board of Education is speedily replacing metal urinals with porcelain in old buildings. In a few of the newest buildings, the old-style wooden seats are being replaced by wood or porcelain seats with open fronts, and occasionally the metal body is replaced by porcelain. In some buildings the stalls in the girls' toilet are provided with doors.

This description held true for most of Cleveland's school buildings, but it should be noted that while the toilet-rooms in the newest schools were distinctly better, there were no schools in the system where conditions were shockingly bad. There are very few cities in the country of which the same thing could be said. The toilet-rooms in Cleveland needed improvements, but the school board was aware of the fact and conditions were rapidly changing. It is unfortunately true that in most schools, even in our largest cities, toilet-rooms are poorly planned, insanitary, dark, and badly cared-for; and very little attempt is being made to remedy the situation.

Location and lighting. In most schools it is probably best to place large toilet-rooms in the basement, with smaller rooms on each floor above, or between floors on stair landings. Basement rooms should be so situated that the sections for boys and girls are entirely separated from each other. Where possible the rooms should have a southern outlook, so that they will be bathed in sunlight during much of the day. Where the southern side is not available, an eastern frontage should be chosen. As was stated earlier, it is exceedingly desirable that basements should not be

sunk more than three feet below the grade level. One advantage gained by the shallow excavation is that plenty of sunlight is thereby made possible.

At least one layer of window glass should be made so that it will admit light and sunshine, but will not allow objects to be seen through it. Certain types of wire glass are excellent for this purpose, since they admit light, are not transparent, and are so constructed as to stand very rough treatment. Where wire glass is not used it is usually desirable to place an iron grating or screen outside the window. It should be remembered, too, that schools are in session only a small portion of each day. Before nine in the morning and after four in the afternoon there is no reason why toilet-rooms should not be exposed to direct sunlight by sliding back the translucent glass windows usually used, and leaving the windows either entirely open or screened with a single thickness of clear glass panels. A little thought will suffice to plan toilet-rooms so that they can actually be flooded with sunlight for several hours each day.

Walls, ceilings, and floors. The walls of the toilet-room should be white or very light-colored, so that they will reflect light and reveal dirt; and they should be made of some material which can be washed frequently, and which presents a surface which cannot easily be disfigured with knife-cuttings or pencil marks. White glazed brick or tile set in cement makes an excellent basement wall, and is not excessively expensive. The ceiling should be white, in a hard, smooth finish, so that it can be washed occasionally without harm. Toilet-room floors should not be made of uncoated cement, because uric acid sets up a chemical action which causes discoloration, and frequently gives the characteristic toilet-room odor. Very little can be done to remedy it. Good floors may be made with a cement foundation over which is laid a layer of asphaltum.

Asphaltum is impervious to water and uric acid, and makes an excellent surface for toilet-rooms.

Floors should be provided with drains, so that they may be washed down with the hose; and should be slanting, so that the water will run off readily. It is not unusual to find new buildings thoroughly equipped with hose, glazed walls, etc., yet built without drains, so that whatever water is used for cleaning must either be wiped up by hand or allowed to evaporate. Toilet-rooms should be separated from the rest of the building by swinging doors, and each should be plainly labeled "Boys' toilet," or "Girls' toilet," as the case may be.

Equipment per number of pupils. The Ohio State Building Code, the rules of the Indiana State Board of Health, and the rules of the Commissioner of Education of New York State require, as a minimum of accommodations for indoor toilets, one toilet seat for every fifteen girls, one urinal for every fifteen boys, and one seat for every twenty-five boys. Other authorities suggest one urinal for every twenty-five boys. In planning new buildings care should be taken to provide equipment or connections so that new equipment may be added for pupils in excess of the number expected during the first year. When portables or additions to the main building are erected, extra toilet provision should at once be made.

Location of equipment. Care should be taken in installing toilet equipment not to cut off light from the windows. It is a common thing to find a long double row of stalls down the center, standing so high that all the farther side of the room is plunged in gloom. Closets should be placed around the sides, with the openings facing toward the sunlight. Urinals may be placed in the center if they are low enough so as not to cut off light, but unless quarters are crowded the plan of placing urinals against the wall is apt to be more satisfactory.

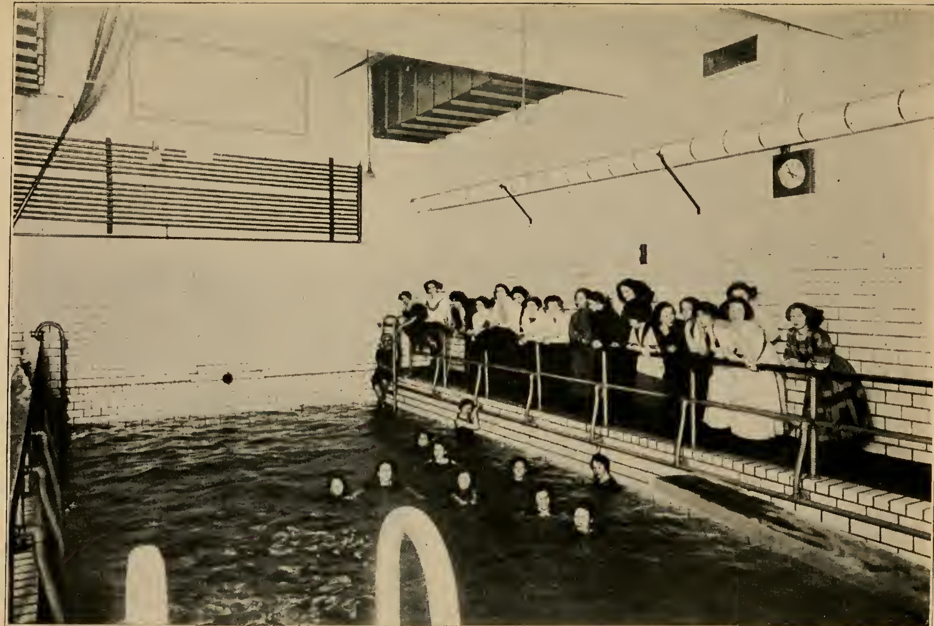

FIG. 16. A SCHOOL SWIMMING-POOL

FIG. 17. TOILETS
Not the right sort of toilets for a healthful school

Urinals. Metal urinals covered with two or three layers of glazed paint are unsatisfactory, because after a comparatively short time the paint wears off and the metal becomes corroded. Schools already equipped with metal urinals should have them removed as speedily as possible, and better types installed; otherwise the toilet-rooms will continue to give out an unpleasant odor. Disinfectants in the toilet-room are a sure sign of defective installation or equipment, and should not be used.

Urinals should be made of porcelain, marble, or glass. Slate is often recommended, but is inferior to the materials above listed because it is not entirely impervious to moisture, and because it catches and holds dirt which cannot be readily detected. The individual tip-bowl type of urinal is probably not desirable for elementary schools, because it gets out of order and is apt to be misused by the boys. Common troughs are especially objectionable, and should never be used. One of the most satisfactory types is that made by stalls with division walls deep enough to screen the occupants. The stalls incline forward toward the bottom, and are continually flushed by overflow pipes at the top which send a layer of water over the entire surface. Water and urine are carried off by a narrow gutter at the base of the stalls. The air of the toilet-room is drawn down over this gutter and out to the ventilating stack. There are now on the market urinals on a circular base with radiating stalls which insure greater privacy, take up less space, and are simpler in drainage and ventilation than the wall urinal.

Latrines. The latrine is probably the simplest, cheapest, and most commonly installed type of water-closet. According to this plan each row of closets is flushed at the same time by a tank at the end of the row. This makes possible a type of plumbing so simple that it rarely gets out of order, and is

therefore greatly favored by school-builders. On the other hand, the latrine closet makes it impossible to flush one of the closets without flushing the rest, and as the intervals of flushing are automatically controlled, ten or fifteen minutes must sometimes elapse before the closet is swept with water. It is usually possible and always desirable to regulate the mechanism in such a way that during recess periods flushing will occur at very frequent intervals. Latrines are frequently hard to ventilate, because of the long periods between flushing, and, if unpleasant odors are to be avoided, it is necessary to provide a very strong down draught for each closet.

It is also true that where latrine closets are used it is difficult to regulate the height of the seat, and primary children frequently experience difficulty in using toilets which are of convenient height for eighth-grade pupils. Where seats cannot be lowered in old buildings, low benches or steps should be provided in several of the stalls, for the use of smaller children.

Individual flush. Individual flush toilets are more complicated in mechanism than the latrine, but when good types are secured they are considerably more satisfactory. Such closets permit different sizes for primary and upper-grade children, immediate flushing whenever needed, and a considerable saving in water. Certain toilets are arranged with automatic flush operated by placing weight upon, or removing weight from, the seat. Others are dependent upon hand flushing by handle, knob, or chain.

The automatic flush is desirable where absolute cleanliness is the main consideration. Voluntary flushing requires that the toilet-rooms be under constant and close supervision, for many children are ignorant concerning the proper use of the toilet, and many others are careless. Because of this fact, and since one of the important duties of the school

is to train children in sanitary habits, it is claimed that the voluntary flushing system is necessary. Where toilets are automatically cleansed the child feels no responsibility and secures no training. The argument is probably valid, and the individual voluntary flush system is probably the best, provided — and this point should be emphasized — that school authorities assume full responsibility for seeing to it that the children are actually taught how to use it. If toilet-rooms are to remain under spasmodic or superficial supervision, some form of simple automatic flush should be installed.

Automatic flush and nerve strain. Another point concerning the flushing system is rarely mentioned in such discussions, but has a very real importance. All those who have had intimate acquaintance with small children know that the automatic flush is frequently a source of terror. The toilet used in the ordinary city home is flushed by hand, and country children are often unacquainted with the flush toilet in any form. In school, clogging of pipes with consequent overflowing occurs frequently enough so that many wild stories are circulated, and the child feels afraid even to enter the toilet-rooms except at recess periods when other children are near. Consequently, when automatic flushing occurs with its roaring sound and the rush of water and spray, nervous children become convinced that the toilet is about to overflow, and the idea may become so vivid that children will suffer for several hours rather than go alone to the toilet-room. Children rarely confide such imaginings to older people, for fear of being laughed at; but there seems to be no question that much unhappiness is daily caused in this way. The noisy, unheralded automatic flush is one of the chief defects in the latrine system. If an automatic flush is necessary it should be arranged to operate on removing the weight from the seat, so that the child feels free to leave the stall as soon as the flow of water begins.

Partitions. Closets should be separated by partitions which are impervious to moisture, light-colored, and difficult to deface with pencil or knife markings. Porcelain, marble, or glass are the best materials for such partitions. Slate is fairly good, although usually too dark in color. Wood should never be used. Each partition should extend to within six inches of the floor, three inches of the back, and should be about six feet high. This does away with corners, and makes it possible to clean floors, walls, and partitions easily, and yet effectually to screen the occupants.

Doors. Each closet should be equipped with a door, arranged to swing inward when not in use and thus expose the entire closet to the germicidal action of the sun's rays. Such an arrangement also makes the task of inspecting the toilet-rooms easier. The common scheme of erecting a screen in front of the row of seats is unwise because it fails to afford the proper privacy, since, in order to reach the end of the row, it is necessary to pass in front of all the other stalls. It is not uncommonly suggested that in matters of toilet arrangements, bathing, and the like, modesty has become confused with prudery, and it is urged that the wisest educational plan would be to do away with all doors, screens, and partitions between individual toilet-stalls, and to teach children to think of such matters in a perfectly matter-of-fact way.

In such arguments clear distinction should be made between training people to be prudish and training them to be considerate of the feelings of others. There is probably no good reason why people should not undress and bathe in front of others of the same sex. There is nothing about the naked body which is repellent or distasteful. The school, therefore, may render a real service if it teaches children to regard the matter of bathing and dressing as a natural process which may properly be carried on as a group activ-

ity. The question of toilet regulations brings very different factors into consideration. The physical processes of evacuating bladder and bowels involve many unpleasant features. Children should be taught to seek privacy for the performance of these acts, not through a sense of shame, but through a fastidious consideration of the feelings of others. At present in our best school systems the trend seems to be in the direction of affording to every child the same degree of privacy which the adult requires in his own home.

Seats. The body of the toilet should be of vitreous ware, which is exceedingly hard, and cannot easily be scratched or stained or broken. Iron bodies covered with white enamel should not be used, because the enamel shortly wears off and the iron becomes corroded and ill-smelling. Toilet-seats should be of glass, porcelain, or other impervious material, with open front. Wooden seats are less likely to chill the body, but are harder to keep clean, and are therefore inferior to porcelain for public places. The floors directly underneath closets should be of asphaltum, marble, or glass, never of wood or cement. All plumbing should be so arranged as to be readily accessible.

Lavatories near toilets. Near the door of the toilet-room or directly outside should be sinks, hot and cold water, liquid or powdered soap, and paper towels. Within the near future the toilet-room for public buildings will undoubtedly be greatly improved; but at the present time doors, latches, paper-holders, and chains must all be touched by the hands of different occupants; and, where persons are careless and hands become soiled, the opportunities for transmitting disease are very large. Typhoid, dysentery and other intestinal disorders, hookworm, and cholera may all be carried in this way. It is difficult for us to arrange toilets so that they will not become contaminated; but we can and should take pains to give every child definite knowl-

edge of the danger of acquiring or transmitting disease by such means; and should insist on each child thoroughly cleansing his hands with hot water and soap after every visit to the toilet. This can be accomplished only by careful teaching and supervision, but it is a matter of too great importance to neglect.

Ventilation. Ventilation of toilet-rooms should be carried on separately from the main ventilating system. One of the easiest and most effective methods is to draw the air of the toilet-room down over the drains in urinals and closets, and out through a ventilating stack in which a draught is kept up by means of a heater placed in the stack. This heater may be composed of steam coils from the main heating plant, but probably a more satisfactory and inexpensive method is to have a small separate fire, of the kind which burns slowly and steadily and does not need frequent replenishing. This fire should never be allowed to go out, even on Sundays and holidays, during the months in which schools are in session. Under no circumstances should the ventilating system of the toilet-room be part of the central system, because where this is the case back draughts are apt to occur and serious trouble result.

Extra toilet-rooms. At least one toilet for boys and one for girls should be placed on each floor above the basement, or on landings between floors, to be used for emergency purposes. There should also be located, at convenient intervals throughout the building, toilet-rooms and wash-rooms for teachers. A toilet-room should be annexed to the office of the nurse or medical inspector, and special toilets should be provided near rooms designed for feeble-minded children. Special equipment has been designed for the kindergarten. In some cities it is the practice to build a large cupboard directly off the kindergarten room to be used for toilet purposes. The toilet stands about ten inches high, and is made

of white porcelain with a small seat and controlled flush. In some cases the lower part of the door is cut away, so that little children may go in and out without having to turn the handle or swing the heavy door.

Toilet-rooms in high schools. In elementary schools, where all children are dismissed for recess or at the end of the session at the same time, it seems best to place toilets in large rooms in the basement, where they can be carefully supervised. In most high schools, however, students have ready access to toilet-rooms at the end of every recitation period, or even oftener, and the problem of supervision becomes serious. It seems to be more effective, therefore, in high schools to place separate toilet-rooms for boys and girls on every floor, each one designed to accommodate only as many persons as are likely to be at work on that floor at any one time. It is essential in planning high-school toilet-rooms to observe the suggestions concerning glazed surfaces, up-to-date equipment, and abundant lighting, because dark and insanitary rooms are almost sure to result in serious disciplinary problems.

The rural-school problem. During the past decade increasing emphasis has been placed upon the necessity for providing adequate toilet facilities in rural schools. Superintendents, principals, and teachers whose sole experience has been gained in city schools can hardly realize how serious is the question of rural sanitation, nor how far behind modern times rural communities are in their knowledge of elementary hygiene. It is with something of a shock that many people view the figures gathered by urban and rural medical inspectors which testify so convincingly to the unorthodox fact that country children are apt to be hollow chested, anæmic, short-sighted, and slightly deaf, with inferior eyesight, crooked backs, decayed teeth, and many forms of digestive disturbances. The city child has a better

chance to reach adult life than his country cousin; and the Rockefeller Commission tells us that in many of the Southern States the barefoot boy is in grave danger of exchanging his coating of healthy tan for the pallid, fish-like stare of the hookworm patient. Any movement which seeks to keep country children on the farm must also see that they are taught how to live healthy, hygienic lives; otherwise it will do much to perpetuate disease.

Hookworm disease. Many of the diseases from which country people suffer are directly traceable to contaminated water and insanitary toilet conditions. There are communities in the United States, many of them in regions which are proud of their cultured history, where farmers fail to provide even the crudest kind of outhouse for sanitary purposes, and members of the family are compelled to resort to cornfields, meadows, forest, and secluded corners behind various farm buildings. This filthy practice on the part of the poorer type of American farmer is largely responsible for the alarming spread of hookworm disease; for hookworm disease is caused by minute worms which live in the intestines and hold themselves in place by means of hooks caught in the intestine wall. They are carried outside the body by human excrement, and if care is taken in its disposal they may be killed and prevented from doing further harm.

Where through carelessness or ignorance body waste is allowed to fall on the ground where people are working, the larvæ which speedily develop are apt sooner or later to come into contact with human hands or feet. They bore their way through the skin and find lodging in the body until they develop into full-grown parasites and are again cast out. Hookworm disease spreads rapidly through whole communities. Barefoot children are especially prone to contract it. It produces anæmia, — ghastly white faces and staring eyes, — it saps energy, and renders people stupid and slow,

so that they appear almost feeble-minded. It has cost the United States many thousands of dollars, but if proper toilets were built and their use enforced it could be practically stamped out in a single generation.

Rural sanitary surveys. During the spring of 1913 a study of rural-school conditions was carried on by the Joint Committee of the National Council of Education and the American Medical Association. The following quotation from their report is taken from Dr. Dresslar's book on *Rural Schoolhouses and Grounds*, published by the United States Bureau of Education, in 1914. The returns were based on studies of two counties each in

Alabama	Missouri	Pennsylvania
Arkansas	Montana	South Dakota
Colorado	Nebraska	Tennessee
Indiana	North Carolina	Texas
Maryland	North Dakota	West Virginia
Minnesota	Oklahoma	Wisconsin

The toilet facilities of the rural schools are, generally speaking, not only a disgrace, but a menace to public health and decent morals. Not over one per cent of rural schools are furnished with completely sanitary toilets. This is a liberal estimate. From the descriptions given in the returns it has been comparatively easy to decide between those which are passably sanitary and those insanitary. The figures are these: Out of 1276 replies examined, 50 schools have no toilets at all; 52 have only one; 174 have two. Nearly half (601) have no pit at all for the refuse, and 631 have an open pit. Not 20 in the whole number are protected against flies or can be cleaned with any sort of success.

The sanitary survey of 3572 fourth-class district schools, made in 1911 and 1912 by the Pennsylvania State Department of Education, shows that nearly 1200 were not clean, and over 1300 had an objectionable odor. At least 839 had no vault to catch the waste; 785 were not watertight, so that at times the contents worked through to the outer air. Over a thousand used no lime or ashes. In 500

schools the vault was already full, and in 208 more it was overflowing.

In another survey, carried on under the direction of the Joint Committee noted above, of the privies of 109 schools in the States of New York, New Jersey, Connecticut, Vermont, and Maryland, 50 were used by both boys and girls, 50 were marked with obscene drawings, 92 were neither provided with excavation nor removable receptacle, and of the 109 only eight were cleaned of their contents more than once a year.

These and similar studies are sufficient to show that insanitary rural conditions are not peculiar to any one locality or stock. Similar conditions may be found in most rural communities, no matter where situated, and they are the usual findings rather than the exception.

Rural-school toilets. Wherever possible the rural school should be equipped with a flush toilet. This is not so difficult to install as is commonly believed; since all that is necessary besides ordinary plumbing is a pressure tank for storing water and a pipe connection with sewer or septic tank.

The septic tank. A septic tank is an arrangement whereby sewage is emptied into a water-tight compartment, in which bacteria are at work to change the solid matter into liquid. As the liquid is formed it is gradually introduced into a second compartment, from which it is carried to a distance and distributed through the soil. If improperly made, septic tanks are dangerous; but various highly satisfactory forms have been worked out, and minute directions are available, so that with proper care farmhouse and country school can be equipped with indoor flush toilets and the sewage disposed of without danger or discomfort. Septic tanks work best on hill slopes or in fairly porous soil. Where the soil is of clay special precautions have to be taken in their con-

struction, so that the leaching process (distribution of liquid) shall be effective.

The location of the septic tank should be at least one hundred feet from the school building and three hundred feet from the source of water supply. Where possible, it should be on a lower level than the water supply, although, if it is properly constructed, and the distributing drains carried to a safe distance, there is little danger of contaminating drinking-water. The tank itself should be constructed of water-tight material — concrete or masonry — carefully made, and plastered inside with a half-inch coat of rich cement mortar. The top may be made of heavy wood on hinges, or of concrete with manholes arranged to permit access to the tanks in case of stoppage. Connection with the plumbing inside the building should be by means of four-inch vitrified sewer pipe, and care should be taken to make all joints impregnable. This is especially important in swampy regions where there is much ground damp, or in wooded regions where the roots of trees tend to break or clog the piping. Entrance to the tank should be below the water level, so that the entering pipe will not become clogged with surface scum. An automatic siphon regulates the escape of liquid from the second chamber to the distributing pipes.

If the distributing point is at some distance the liquid may be carried by sewer pipe, carefully laid, on a grade of not less than two feet in every one hundred feet. These distributing pipes should be hard-burned agricultural drain tiles. Distributing tiles should be about one and one-half feet below the surface of the ground, and should fall three inches in every one hundred feet. If care is not taken in regulating this fall much difficulty will be experienced, because liquid will either accumulate at one spot near the entrance or rush too suddenly to the extremes of the pipes. From two hun-

dred to four hundred feet of distributing tile will be necessary, depending upon the amount of sewage and the nature of the soil. Where soil is mostly clay it is desirable to lay distribution tiles in trenches upon beds of cinders or gravel, and cover with earth. Tiles may be laid in one line or in branches; but in the latter case it is important that they should be so laid as to receive equal amounts of sewage. The ground above the distribution tiles should be planted with grass or flowers.

It is of the greatest importance that whenever septic sewage disposal tanks are to be built, directions be secured from competent authorities, and minutely followed. Poorly built tanks may result in unpleasant odors, pollution of soil and water, gases within the building, or clogging of pipes; and one such tank will do much to discourage hygienic activities in the community. Directions for the construction of septic tanks may be secured from various State boards of health.

Location of rural toilets. School toilets should be so situated as to be easily under supervision of the teacher, reached quickly, and without exposure to the weather, readily accessible from the playground, and so arranged as to have separate provision made for the sexes. The best place for toilets is within the school building — usually in the basement, with sections at opposite ends for boys and girls. Where water can be secured under pressure, and sewer or septic tank connections made, the indoor toilet is readily installed. If such arrangements cannot be made toilets must be placed outside.

Outbuildings should be placed fifty feet away from the main building and from the drinking-water supply. Buildings for boys and girls should be placed at a considerable distance from each other, and the approach should be screened by vines on trestles or by shrubbery. Dr. Dresslar

suggests planting evergreen shrubs, so that a thick screen may be formed in winter as well as in summer. Each building should be well constructed and kept in good repair. Windows and ventilating openings should be screened so as to exclude flies and mosquitoes. Doors should be carefully hung so as to fit tightly when closed, and should be provided with latches on the inside and padlocks on the out, so that they may be closed to tramps when the school is not in session. Doors should swing shut when not in use.

Dug privies. The ordinary privy, which consists of a wooden house set over a shallow hole dug in the ground, is utterly unsafe, either for farm or school. In some instances the nature of the soil is such that it does no harm, but without a careful geological survey it is usually impossible to make sure, and there is serious risk of contaminating drinking-water and surrounding soil. Moreover, in such privies it is exceedingly difficult to exclude flies and mosquitoes, and as a result there is constant peril of typhoid epidemics.

The L.R.S. Privy. There are only two types of privies which can be considered safe. In one, the contents are dispersed by a septic tank arrangement, such as that just described. In the other, the contents are removed at frequent intervals. Of this second type probably the best form is that devised by Drs. Lumsden, Roberts, and Stiles of the United States Public Health Service, and known as the "L.R.S. Privy." The L.R.S. privy is constructed on the principle of the septic tank, but instead of distributing the liquid by means of drains, it allows it to flow into barrels, which are then carted away and emptied. In some cases the effluent tank is stationary and the liquid is pumped into separate vessels. It is important to note that in any privy operated on the principle of septic tank disposal disinfectants must not be used, because the tank depends for its successful

operation on liquefying bacteria which would be killed by carbolic, lime, potash, and the like.

Dry privies. Dry privies may be made by providing a strong, water-tight box or tank which may readily be removed and carted away, or by building a waterproof pit of brick or concrete. Access should be had to box or pit by means of doors at the back of the privy hung on hinges and made to fall in place and fit tightly. Each dry privy should be furnished with a plentiful supply of dust or ashes, and children should be taught to use it.

Buckets are easier to empty, and require emptying more frequently than pits or tanks. The contents of the dry privy should be carted to a safe distance and buried.

Outhouses. The usual privy is supplied with two seats. These should be separated by a partition to secure greater privacy. One seat should be about a foot high, for use of the smaller pupils; the other about sixteen inches high, for older pupils. A urinal should be supplied in the boys' toilet. The practice of placing an inclined trough outside the building, emptying into the privy vault and protected by a high fence, is probably unwise because it encourages groups of boys to gather within the enclosure and leads to undesirable play. It is necessary, however, to provide some form of urinal within the building, since otherwise boys use the dust-bins or floor for that purpose, or allow the toilet-seat to become soiled. It is sometimes necessary to build a slanting projecting shelf above the seats in such a way as to prevent boys from standing upon them. It is usually wise also to provide a dust-bin with a closed top, and a place for removing dirt at the side or bottom. The seat-box above the vault should be lined with zinc. Seats should be of wood, and covers of wood lined with zinc. Covers should be fastened with hinges and arranged to fall of their own weight. Openings for ventilation should be

provided near the roof, and should be covered with wire screens.

Detailed suggestions have been given for the construction of outdoor privies because they are the commonest form of toilet for the rural school. Local authorities should, however, seriously consider the question before deciding in their favor. The privy of the country school is removed from supervision. It is unattractive and sometimes repelling in appearance. Because it is built of wood it is usually covered with obscene markings. Not infrequently it is the scene of disgusting and immoral practices, in which the younger children are too often allowed to share. An indoor flush toilet is more expensive than a dry privy; but its educational influence is decidedly preferable.

QUESTIONS FOR STUDY AND DISCUSSION

1. Make a study of different types of toilet-room equipment now on the market, comparing them as to cleanliness, freedom from odor, durability, simplicity, cost.
2. What are the common ways of ventilating toilet-rooms? How do they work?
3. It is commonly said that the emptyings of privies form an excellent fertilizer, and farmers frequently use them for that purpose. Dr. F. B. Dresslar and others claim that the opposite is true. What evidence can you find bearing on the question?
4. How is the sanitary toilet question handled by the army in time of peace? In time of war? What provisions are made in logging or construction camps? What precautions are taken to prevent epidemics caused by poor toilet arrangements? What suggestions can be gained for public school practice?
5. How and to what extent should toilet-rooms be supervised?

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CHAPTER VIII

HEATING AND VENTILATING

The lesson of contagious disease. Several years ago, when questions of school hygiene first began to assume a prominent place in educational discussion, studies were made showing the number of cases of contagious diseases among school children for each month in the year. It was shown with astounding clearness that the number of cases increased with the beginning of cold weather in the fall, reached a high peak during the most severe winter months, and gradually diminished as spring came on. The hygienic implications were all too clear, for the epidemic of contagious diseases coincided almost exactly with the periods during which classroom windows were closed and classrooms were artificially heated. One of the results of this discovery was the beginning of the medical inspection service. Another was increased interest in and attention to the problems of ventilation.

During the past decade immense amounts of time, thought, and money have been expended in the effort to secure for school buildings the best possible systems of heating and ventilating. The hot-air furnace has been replaced by steam boilers. Window and gravity systems of ventilation have given way to the electrically driven fan, which blows air into the classrooms. Elaborate thermostat systems have been installed, and in order to keep them working properly teachers have been warned that windows must be tightly closed, for heating plants are sensitive things, and nothing must be done which might disturb their equilibrium. Careful tests have been made to measure the carbon dioxide

content of the classroom, and heating engineers have conscientiously tried to see to it that each child received his 33.3 cubic feet of hot fresh air every minute during the school day. But in spite of all these improvements the results have been discouraging. Epidemics of measles and scarlet fever have become rarer, because doctors have been on hand to detect preliminary cases and remove the offenders from the room, but colds and grippe are nearly as common as heretofore. Classrooms are frequently stuffy and filled with unpleasant odors; and teachers, after vainly endeavoring to live up to the rules, desperately seek relief by flinging windows wide open.

Survey findings. This does not mean, however, that the newer mechanical devices have proved worthless. It is true that ventilation, even in our newest buildings, is frequently ineffective, but in the old buildings where fans have not been installed, and heating and ventilation are of the window or gravity type, conditions are sometimes almost appalling. Take, for example, the conditions disclosed in some of the recent surveys of educational systems. The report from Springfield, Illinois, runs as follows:—

Most of the schoolrooms of Springfield are overheated. The temperature records taken in classrooms by the members of the survey staff were one hundred and seventy in number, and showed a range from fifty-eight to eighty-six degrees. The maximum temperature allowed in classrooms should be about sixty-eight degrees. More than two thirds of the temperatures taken were above this, and nearly half of them were above seventy degrees.

In a number of the buildings the outdoor inlets are kept shut; in others, the air is sucked out of the basement and toilet-rooms instead of coming from outside, and in a considerable proportion of the buildings some part of the equipment has been left uncompleted or is out of order, so that the ventilating system works only partially.

For Salt Lake City we find "members of the survey staff repeatedly entered schoolrooms which had the stifling

temperature of seventy-five to eighty degrees." Judging from the records we may conclude that more than twelve hundred children in this city were daily subjected to suffocating temperatures above seventy-four degrees. It is little wonder that twenty per cent were subject to frequent colds, or that more than eight per cent were found to have chronic throat or nose trouble. "It is recommended that in future buildings, and wherever possible in the old buildings, air washers be installed. The discolored walls of very many rooms show that dirty air is being forced into the building. Air washers are not expensive, and they prevent the breathing of much injurious dust. The prevalence of smoke in the atmosphere of Salt Lake City during certain months of the year, renders their use more than ordinarily urgent in this city." Finally we read in the Denver Survey, "In all the Denver schoolrooms, with the exception of two buildings, the air of the classrooms is found to be as dry as that of a Sahara Desert."

Early theories concerning ventilation. One hundred and thirty years ago the great French scientist Lavoisier succeeded in identifying carbon dioxide gas. This gas was a poison, and for over three quarters of a century after it was identified scientists believed that the presence of too large quantities of this gas was responsible for the harmful effect of impure air. About 1861, however, the German chemist, Von Pettenkofer, conducted a series of experiments in which he was able to demonstrate that an excess of carbon dioxide was not responsible for the unpleasant symptoms noted in over-crowded or ill-ventilated rooms. While he was convinced that the gas was not dangerous, nevertheless he felt that since it was always found where many people were gathered in small, closed rooms its presence in considerable quantities did offer a trustworthy index of the presence in the air of other harmful impurities.

It was on the basis of the work done by Lavoisier and Von Pettenkofer that many of our State laws on ventilation have been formed. These laws specify that the percentage of carbon dioxide in the air or buildings must not be permitted to exceed from seven to ten parts in ten thousand, and our ventilating systems are built to keep the amount of the gas within these limits.

Some recent experiments. Within recent times, however, a series of exceedingly interesting experiments have been going on which are resulting in new and vastly different theories concerning ventilation. At the University of Minnesota, for example, two stalls were built as nearly air-tight as they could possibly be made. In one of these a steer was confined for thirty-seven days and lived in perfect comfort and robust health. He made true and steady gains in weight, and seemed not to suffer in any way. In another a steer was kept for twenty-eight days. This animal's horn was accidentally broken, but not only did he enjoy perfect health and comfort, but his wound healed with remarkable celerity, in an atmosphere so contaminated that the carbon dioxide content rose to ninety times the normal.

Professor Leonard Hill, of England, caused a small room to be built and made completely air-tight. In this room his students lived and worked for days at a time in perfect health and comfort. He writes: "We have watched them trying to light a cigarette to relieve the monotony of the experiment, and, puzzled by their matches going out, borrowing others, only in vain. They had not sensed the percentage of the diminution of oxygen, which fell below seventeen." (That is, seventeen per cent of normal.) The normal proportion of carbon dioxide in outdoor air is about three parts in ten thousand. The greatest amount permitted by ventilating laws is commonly ten parts. In experimental chambers of the kind conducted by Professor Hill the pro-

portion has risen as high as two hundred and thirty-one parts, or eighty times the normal amount without any bad results whatever.

In one of Dr. Hill's experiments eight persons were confined in a small, air-tight chamber which contained approximately three cubic meters of air. The oxygen fell from twenty to between sixteen and seventeen per cent, and the carbon dioxide increased from .04 to between three or four per cent, or nearly one hundred times its usual amount. As the oxygen fell, the eight persons in the chamber showed all the unmistakable signs of suffering from vitiated air. The temperature was between eighty and eighty-five degrees Fahrenheit, and was very moist. After a short period three electric fans attached to the ceiling of the room were started. The air remained just as hot, just as wet, and just as stale as it had been before, but the turning-on of the electric fans brought complete relief, for the simple reason that it whirled away the still hotter stationary air which had gathered as a sort of an envelope on the surface of the body, and allowed the heat generated by the body to be carried off.

Of perhaps equal interest are the experiments of Dr. Paul, of the University of Breslau, who found that when human beings were placed in experimental chambers where the air was hot and very humid, symptoms of discomfort appeared within a very few minutes, long before enough of the poisonous gases could have accumulated to account for the change. Without telling the subject in the room what was happening fans were started, which caused the air to move rapidly about. Almost at once the unpleasant symptoms disappeared. The skin became cool and moist, and the subject felt that fresh air had been supplied to the room. Later the fans were stopped, and, after the subject had been confined in the experimental chambers for some time and had again shown all the acute symptoms of foul-air poisoning, a tube

was passed through the wall of the chamber and the subject was allowed to breathe fresh air from outside through the tube. Strange as it may seem, although he was filling his lungs with plenty of pure, fresh air, the subject continued to feel just as uncomfortable and stifled as before. Then the process was reversed, and one of the men on the outside applied his nose and mouth to the openings of the tube and filled his lungs over and over again with the foul air contained in the closed chamber. He suffered not the slightest discomfort. It is as a result of these experiments that we find the amazing statement: "Air is not to breathe, but to bathe in." Stagnant air is like a hot wet blanket wrapped tightly around the person's body, so thick and impenetrable that the body heat cannot escape, and a man is, in a certain very real sense, "consumed in his own fires." When the covering is broken up and the air put in motion relief comes.

Another interesting piece of evidence is cited by Dr. Leonard P. Ayres, in an address before the National Education Association, in 1911. He says: —

> A recent impressive illustration occurred last winter, during the final stages of construction of a Connecticut school building equipped with humidifying apparatus. During the very cold weather in December the carpenters employed on the inside finishing work complained of the cold with the thermometer at seventy-five degrees. The foreman did not wish to force the temperature higher, because the new woodwork was already opening badly at the joints. Suddenly a discussion with the architect about the new humidifying apparatus occurred to him, and he had the steam turned on in the fresh-air chambers. Soon the frost began to appear on the windows, and in three hours the cracks in the new woodwork were entirely closed. The most remarkable result, however, was the effect of the humidity upon the workmen. Before the steam had been on half an hour the men who had been complaining about the cold began to take off their coats and then their vests. The temperature was lowered, and soon the men were happily working in their shirt-sleeves with the temperature at sixty-eight degrees.

The Springfield Y.M.C.A. experiment. One of the most interesting experiments from the point of view of school men was that carried on during the winter of 1912 in the gymnasium building of the Y.M.C.A. training college at Springfield, Massachusetts. This is a large modern building, including two gymnasiums, laboratory, offices, and classrooms. It is used practically all the time. Under the direction of Dr. James H. McCurdy an experiment was instituted in which, instead of taking air from outside the building and delivering it heated to the various rooms, as is the usual plan, the gymnasium was run for weeks at a time by simply using the same air over and over again. The only fresh air which was allowed in the buildings was that which came in through natural leakage. When the process of re-circulation of air was well under way, careful tests were made to determine the volume of air moved, the humidity and temperature, the chemical constituents of the air, and the feelings of the students who were working in the building. The results were amazing.

It was found, in the first place, that through the process of re-circulation it was possible, by washing the air carefully each time it was circulated, to keep it more free from dust and bacteria than the air outside. In the second place, the washing of the air also removed all unpleasant odors so that the building smelt sweet and clean. In the third place, the air was kept at the right degree of moisture. In the fourth place, during hot weather it was just as possible to cool the air of the building by the washing process as it was to warm the building with moist clean air during the winter. In the fifth place, and from some points of view most amazing, the expense of operating the ventilating and heating plant was reduced from $1.07 to $.52 an hour. This reduction was largely due to the fact that under ordinary conditions it is necessary to take the air at the outside temperature and

bring it up to room temperature. When the re-circulation is in process, extra heat is needed only to make good the heat loss which the air has incurred during its passage through the building.

The Springfield experiment has been so successful that many people do not hesitate to declare that ventilating schemes of the future will be entirely based on the re-circulation plan. In discussing this matter Dr. Luther H. Gulick has said: —

> Ventilation seeks to control the conditions of the atmosphere in which the body is immersed, rather than to control its composition; because its composition is practically stable and needs no attention, while its condition is exceedingly changeable as well as important. The ideal ventilation for a school building consists in re-circulating and properly conditioning its contained air. The advantages are that the air may be kept under more health-giving conditions, through more perfect control of temperature, humidity, air movements, dust, odors, and also because of the financial saving. That is, we have now arrived at such a knowledge of ventilation that it is possible to have indoors and practically all the time those conditions which are found outdoors only when Nature is at her best. Man has at last accomplished, with reference to the air he breathes and in which he is enveloped, what he learned to do years ago with reference to the water we drink — have it at its best all the time.

Other experiments, quite different from that so glowingly referred to by Dr. Gulick, were those carried on in the open-air classes for tubercular children. Here it was found that under the conditions of open air, warm clothing, good food, and plenty of sleep, children became healthier and more alert than were their classmates in the best-ventilated schoolroom. All the evidence of the open-air classroom seems to point away from the validity of the re-circulation plan and toward the necessity of having entirely fresh air surrounding the children. As a matter of fact, however, there were so many elements entering into the open-air class experiment

that the success of the work could not properly be attributed to the one cause of open air. One fact, however, proved to be especially significant. It has been demonstrated clearly that children who attend the open-air class speedily improve in appetite. This has been found true even in those cases where children in the open-air classes did not seem to gain in any other way. Until recently very little attention was paid to this fact, but within the past few months experiments have been conducted which emphasize its importance from the point of view of classroom ventilation.

Work of the New York State Ventilating Commission. In 1913, at the request of the New York Association for Improving the Condition of the Poor, the Governor of the State appointed a ventilation commission for the purpose of studying, in a scientific manner, various problems of ventilation. The cost of the commission was met from part of a fund established by Mrs. Elizabeth Milbank Anderson for carrying on various phases of constructive social investigation. For the past three years this commission has been carrying on a series of extensive and very careful experiments, and has come to some exceedingly interesting conclusions. It finds, for example, that even very hot, moist rooms have very little effect upon the actual power of the subject to do mental work. Heat raises the temperature of the body, increases the heart rate, and lowers the blood pressure. People do not feel like working in a very hot, damp room, but if obliged to work they do so very successfully. Stagnant air at the same temperature as fresh air, even when it contains twenty or more parts of carbon dioxide and all the organic and other substances in breathed air of an occupied room, according to the commission's findings, has no effect on any of the physiological responses listed above, nor on the power to do physical or mental work, nor even on the sensations of comfort of the subject breathing it.

On the other hand, and this is an immensely important finding, the commission found that vitiated air results in a diminished appetite for food. When it is moderately cool and in motion students can work, study, and play in foul air as properly as in fresh, but they cannot work up an appetite in it. In the New York Commission's tests, after the subjects had been in the experimental room for some two or three hours, a luncheon, made up of weighted portions of known caloric values, was served and the amount of food left uneaten was weighed, to determine by difference the amounts consumed. The diet was varied from day to day, but was so arranged that each article of food appeared an equal number of times on days when regular ventilation was provided and on other days when only foul air was admitted to the chamber. On the no-ventilation days the carbon dioxide averaged between twenty-nine and fifty parts, and there was usually a slight odor noticeable in the room. Sometimes the odor was strong enough to be unpleasant. It was found to be a practically unvarying rule that more food was eaten on the days when ventilation was supplied than on the days when subjects sat in foul air.

It is interesting to note, too, in connection with this experiment, that when the subjects were asked each day concerning their opinions as to the comfort of the atmosphere — the actual condition being kept secret — they usually felt that the no-ventilation days were the more comfortable. In giving its report the Commission said: —

> These experiments seem to warrant the conclusions that there are substances present in the air of an unventilated, occupied room (even when its temperature and humidity are controlled) which in some way, and without producing conscious discomfort or detectable psychological symptoms, diminish the appetite for food. The effect of such an influence might in time be very important, and it seems possible that the observed beneficial effect of fresh air may to some extent be connected with this phenomenon.

Five principles of ventilation. The experiments described above are only a few of the many which have been carried on. Although the results are in some cases confusing, and many problems have arisen which call for further experimentation before they can be settled, there seem to be five general rules which have been fairly well established.

1. Air warm, not hot. In the first place, air should be warm, not hot. Probably one of the most important results of over-heating in the classroom is that originally demonstrated by Leonard Hill, and later confirmed by James Alexander Miller, of the New York Commission. These scientists have succeeded in demonstrating that over-heated air promotes congestion of the membranes of the nose, which in turn frequently brings about a susceptibility to infection. It now seems probable that many of our colds and coughs may be charged directly to over-heated rooms. It was found in the New York Commission on Ventilation experiment that the temperature of the body rises at almost exactly the same rate that the temperature of the room rises. The most desirable temperature for the classroom where children spend most of their time sitting still seems to be from sixty-five to seventy degrees Fahrenheit, depending upon the humidity of the atmosphere and the amount of motion in the air.

2. Air clean, not dirty. The second rule is that air should be clean, not dirty. This rule applies more to the air which we take into the lungs than to the air which surrounds the body. Dirty air is apt to carry with it small particles of mineral matter which pierce the lining of the lungs and set up an irritation which may result in the beginning of tuberculosis.

3. Air moist, not dry. The third rule is that air should be moist, not dry. All outdoor air carries with it a great deal of moisture. When we take a cubic foot of out-of-door air at

a temperature of thirty-two degrees and heat it to seventy degrees, we have multiplied its capacity for holding moisture three and one-half times. If we do not add to our heating plant some method of supplying the extra moisture which is needed, we fill our classrooms with dry, thirsty air, which quickly flows around the bodies of the children and absorbs the moisture on their skins and mucous membranes. As soon as this protective covering of moisture is taken away the skin becomes dry and parched, the face is flushed, and the mucous membrane surfaces become irritated, so that they are peculiarly sensitive. As was suggested earlier, dry, hot air renders children especially liable to catch contagious diseases.

In considering this question of the action of dry air upon the skin it is interesting to compare the complexions of girls in Ireland, the Maritime Provinces of Canada, and the coast districts of Washington and Oregon, with the complexions of the women in those of our Western and Middle Western States where there is little rainfall and the air is particularly dry. Humidity, of course, is not the only factor which enters into the question of clear skin and rosy cheeks. Moderate temperature, for instance, seems to be a help, and extreme hot or cold weather a hindrance. But, in general, it seems to be true that under ordinary outdoor temperature the body thrives when the humidity shows from fifty to eighty per cent of saturation, and suffers when the humidity drops very much below this point. When we read the reports of the various educational surveys, which tell us that the average air in classrooms visited ranges from only twenty to thirty degrees of saturation, we can easily understand why it is that plants in a classroom wither and die and children become weary.

4. Air moving, not still. In the fourth place, air must be moving, not still. Sometimes in a cold room it is found that,

although the radiators are very hot, they do not seem able to pass their heat out into the room. If we open the doors and windows for a minute or two and then quickly shut them we find that something seems to have happened to the way the radiators work, and the room becomes quickly warm. The explanation is that in the quiet classroom each radiator has become surrounded by a thick blanket of quiet air which has held in the heat and prevented it from passing to the rest of the room. When doors and windows were open a draught was created, which broke up this blanket and set the air of the room into motion.

In certain ways human beings are very much like the radiators. They are constantly giving heat off into the air. If the air is very still, it forms a blanket around the body, which holds in the heat and prevents it from being properly carried away. If the air is hot and dry, it absorbs the moisture around the body, and this process of evaporation cools the skin; but if the air is damp, evaporation cannot take place, and the body is held by a hot, sticky blanket which renders the person most uncomfortable. If doors or windows are opened, or an electric fan is started, just as was the case with the radiator the air is set in motion and driven away, so that heat is carried off and the body is bathed in a moving stream of fresh, cool air. Under ordinary classroom temperatures absolutely quiet air is extremely uncomfortable. All the air in the classrooms should be moving all the time. A few years ago air entering the classrooms was calculated on the basis of the amount each child needed to breathe. Now we are coming to believe that the important thing is to find out how much air the child needs to bathe in.

5. *Air of changing temperature.* The fifth rule is that air should be of changing temperatures. Dr. Ellsworth Huntington, of Yale, was one of the first people to demonstrate clearly the stimulating effect of changes in tempera-

ture. Dr. Huntington studied the wages of factory workers in Connecticut, and the marks of students at West Point and Annapolis. He found that hot weather makes people somewhat inefficient and cold weather makes them even more so. But, generally speaking, when the temperature is not above seventy or below forty-three, any change in weather, whether it be warmer or colder, seems to have a distinctly stimulating effect.

It is a well-known fact that warm countries seem to make people lazy, and Northerners are apt to speak scornfully of those who have the "to-morrow" habit. It is true that living in the land of perpetual summer does have a curiously discouraging effect upon the desire to work, and the reason probably is to be found in this very question of changes in temperature. Where the range of temperature is very slight, and the thermometer registers very nearly the same day after day and week after week, even though there are no excessively hot periods, mind and body begin to work slowly. The human organism needs the stimulus of change.

So we have our five modern principles of ventilation. Air should be warm, not hot; clean, not dirty; moist, not dry; moving, not still; and of constantly changing temperatures. If these principles are valid, and all the evidence seems to be pointing that way, it means that all our present systems of heating and ventilation must be subjected to careful scrutiny, for they were devised to fit very different theories. We shall retain some of our methods because we find they work, and our changes will come in the explanation we give for them. There are other schemes which we have tried, however, and with which we have already had to acknowledge failure. Here we must cast aside the old apparatus and systems of heating and ventilating, and experiment with new methods and new processes in the light of our more recent discoveries.

The ventilating engineer. There are two main reasons why the ventilating of schoolhouses is usually so unsatisfactory. In the first place, it is not until very recently that physiologists or medical men have begun to find out what they mean by fresh air. Even now, statements as to what kinds and conditions of air are most suited to the human body are in the nature of hypotheses, which furnish us with guides for practice and experiment, but have still to be subjected to more definite proof. Ventilating engineers have been trying to give good ventilation without knowing what good ventilation is.

The other probable reason for unsatisfactory conditions in schoolhouses lies in the fact that even at the present time school boards and superintendents fail to realize that the problem of ventilating and heating belongs to a special field, and must be handled by experts in that field. When a new building is being erected the architect is usually asked to take charge of installing the ventilating system. In some cases he secures the assistance of a competent heating and ventilating engineer, and places the whole matter in his hands. All too frequently, however, the architect feels that he knows enough to supervise such work himself, and the heating and ventilating plant is installed by a contractor under the supervision of the architect. Mr. G. G. Kimball, one of the members of the New York Commission, has estimated that the cost of the very best engineering services for the design and supervision of a heating and ventilating plant varies from one half to three quarters of one per cent of the cost of the building. Where a first-class engineer is employed the amount saved in installation and operation is immensely greater than his charge for services. The installation of such a plant is always costly. Errors in planning and building are easily made, and once made are frequently impossible to repair. An inferior plant is so difficult to

handle and so seriously impairs the efficiency of the school that neglect to hire competent engineering service in the first place is evidence of a stupid and short-sighted policy.

Not only must the equipment be planned and installed under expert supervision, but care must also be taken to see that adequate funds are placed at the disposal of the engineer. It is peculiarly true in the field of heating and ventilating that an adequate initial investment saves constantly incurring heavier expenses later. Whenever a school board contemplates cutting down the appropriation, it should first give the heating engineer a chance to argue in defense of his original plan.

Legislation. As those who are building schoolhouses try to put into practice the modern theories of heating and ventilating they will find that in many cases progress is seriously hampered because, in an effort to insure good conditions in school buildings, laws have been placed upon the statute books making compulsory conditions which now seem unadvisable. For example, in Delaware, Idaho, Indiana, Massachusetts, Montana, New Jersey, New York, Pennsylvania, South Dakota, and Vermont, the law requires that the temperature be kept at seventy degrees Fahrenheit. Recent investigation seems to show that if the air is properly humidified temperatures not higher than sixty-five degrees are desirable, and seventy is certainly too high. In twenty-one States the law requires that fresh air be provided at the rate of thirty cubic feet per pupil per minute. The wording of these laws and regulations varies, but it is possible that in many States attempts to install systems of re-circulation of air will be blocked by existing laws.

In a similar way, various States give definite direction for the location of air inlets and outlets, their size, the installation of registers, flues, dampers, and the like. In New Jersey the velocity of the air introduced should not be over

three hundred feet per minute. In New York it must be over three hundred, but not more than four hundred feet per minute. In some States the regulations concerning heat and ventilation are the results of legislative enactment and can only be changed by legislative procedure. In others the matters have been left to the discretion of the State board of health, chief of police, or board of education. It is to be hoped that future regulations will be of this latter type, so that they may be changed if scientific experiment later points to the desirability of doing so.

Stoves. Practically all rural schools of the United States are heated by stoves. In all too many cases the stove is placed in the middle of the room and is of the old-fashioned type with direct radiation, so that children sitting near are uncomfortably warm and those at a distance are cold. Fortunately, in many States there has been a direct and strong movement away from the old-fashioned unprotected stove and in favor of the jacketed stove. In some cases this is brought about by prohibitory rulings or legislation. For example, Indiana makes it a requirement that all stoves shall be surrounded by a jacket consisting of two sheets, the outer sheet being of heavy galvanized iron lined with sheet asbestos. The inner jacket, which must be not less than three quarters of an inch distant from the outer, must be of tin or some other suitable metal. The jacket must stand at least three inches away from the stove, and must extend to the floor.

North Dakota and Minnesota, while actually not legislating against the unjacketed stove, provide State aid where stoves of the proper kind are supplied. In Minnesota, if aid is to be granted, the jackets must be of iron or copper-plated steel, with a lining of asbestos and an inside lining of tin, with ample air space between. It must stand six inches away from the stove, and the lower edge must not be less

than twelve inches above the floor. South Dakota makes the approval of rural-school plans by the State Superintendent dependent among other things upon having stoves supplied with a metal jacket extending one or two feet above the stove, and with arches around the bottom extending from eight to ten inches above the floor.

The reason why so much emphasis is placed upon using a jacket for schoolroom stoves is, that without the jacket heat is distributed only to those children who are sitting near the stove. No currents of air are set up, and the heat is not carried to other parts of the room. With the jackets properly made and adjusted, cold air is admitted from the outside of the building, is carried up inside the jacket, and warmed as it circulates around the stove, and passing up through the jacket, flows out through the room near the ceiling. The foul air of the room is drawn under the jacket and acts as a draught for the fire. Part of it also mixes with the fresh air being admitted from the outside, and is recirculated throughout the room. Where jackets are properly made and installed, the system works fairly well. It is usually necessary, however, to open the windows instead of merely depending on stoves for ventilation. Ventilation secured in the latter way is thoroughly successful only when great difference is noted between inside and outside temperatures.

Furnaces. The furnace is constructed on the same principle as the jacketed stove. It consists roughly of a fire-box inside, a jacket outside, and space between to which air is admitted and where it becomes warm and is then sent through pipes to the rooms of the building. Furnace fires form an easy way of heating school buildings. They cost very little, are simple and inexpensive to repair, and are so simple to run that very little special training is necessary for the job. Another and very important factor is that the

furnace fire can be allowed to go out at the end of the school day without danger of putting the system out of order. The chief disadvantage of heating by means of furnaces is that it is very easy to make the fire too hot, so that the air when sent up into the classrooms is actually hot instead of warm. As we have already seen, children do not need to be supplied with hot air in order to keep them comfortable on cold days; what they do need is a plentiful supply of rapidly moving, warm, moist air. It is possible to equip furnaces with fans and moistening apparatus, so that these two latter requirements may be provided, but there are at present very few places where this has been done.

It is also difficult to distribute the warm air evenly in the different rooms of the building. Usually one or two rooms will receive more than their share because the supply pipes are shorter and run at a more direct angle to these rooms. Even where all supply pipes are furnished with dampers, it is not always easy to see to it that every room is properly heated.

In the third place, furnaces frequently get out of order, and the gases formed in the fire-box are allowed to leak through cracks into the air-box and so find their way into the classrooms. Furnaces are still being used in our old buildings and in some of our new small buildings, but they are rapidly being displaced by other forms of heating.

One of the difficulties most frequently encountered in using hot-air furnaces for school buildings is that when a wind blows strongly against one side of the building the air pressure on that side becomes so strong that it prevents hot air from rising through the furnace pipes into the rooms on that side. When candles are carried from room to room it is found that in certain rooms the flame flickers outward, but in others it is actually drawn down toward the register, because, instead of having hot air come up into the room,

the cold air already contained in the room is being sucked down by the furnace.

It was because of the difficulty of distributing heat evenly to all the rooms of the building on windy days that furnace heating fell so much into disfavor. It is interesting to note, therefore, that recently experiments have been made which seem to show how to obviate this difficulty. At present some of our most carefully planned private residences have given up the idea of steam heating and returned to hot-air furnaces. Each room in the house is provided with a flue which goes up through the walls and empties into an air chamber at the top. By means of this construction, even when all the doors are closed between rooms and strong winds are blowing against one side, the air pressure throughout all the rooms is equalized and the heat from the furnace is therefore able to distribute itself to all parts of the house.

These new houses, also, are usually provided with a means of cutting off the outdoor intake. When the weather is extremely cold the intake from outdoors is closed and the air already within the house is re-circulated, either through natural circulation or with the assistance of an electric blower. This means, of course, an immense saving of fuel and the results secured seem entirely satisfactory.

The experiments just described have been actually tried out in a sufficient number of cases so that there seems to be little doubt of the success of the scheme. It is probably true that when school buildings of moderate size are built with flues and equalizing air chamber, the hot-air furnace will form an economical and exceedingly satisfactory method of heating.

Hot-water heating. Systems of heating schoolhouses by hot water seem to be much more used in England than in the United States. In this country they are rather out of favor, probably because after being installed they are

constantly getting out of order and because, since they need a large radiating surface, the installment of pipes and radiators is rather cumbersome and expensive. Systems of hot-water heating are simple and very easy to handle. They do not require either very constant attention or very much skill. Admirers of the system claim that hot-water plants easily carry heat for long distances, so that the system is particularly adapted to central heating plants which supply rooms of buildings at some distance from the center.

Steam heating. In the United States the commonest form of heating for school buildings is by low-pressure steam plants. Steam radiators give out a steady supply of warm air which is never overheated, and the steam supply may easily be turned on or cut off from different rooms by a very simple mechanism. As is the case with hot-water heating, it is possible to carry the steam from a heating plant at a considerable distance from the room or building. Steam is particularly useful as a heating medium, moreover, because it can be supplied in so many different ways for various types of direct and indirect heating. The disadvantages of steam heating are, first, that it is rather expensive to install and repair; second, changes must be made slowly so that if it is necessary to turn on the heat in a building in a short time or to cool a room rapidly trouble is usually experienced; and third, in cold weather it is necessary to have fires going all the time because otherwise there is danger of pipes bursting.

In general it is probably undesirable to use high-pressure steam systems for public schools, unless the heating plant is in a separate building from the rest of the school. High-pressure plants are much more dangerous than low-pressure, and not very much more effective for school purposes.

Heating and ventilating schemes. There are a great many different combinations of methods of heating and ventilating.

Most of these belong to one of three groups. The term "direct heating" is usually used to mean heating by means of radiators placed under the windows or pipes run around the sides of the classrooms. The windows are the coldest spots in the room. Cold enters around the glass and radiates from the glass pane. When radiators or steam pipes are placed directly below windows, they heat this cold entering air before it has time to escape into the rooms. Many school buildings and most office buildings are heated by the direct method alone.

Indirect heating means that air is drawn over pipes or radiators and then carried by flues to the classrooms. Sometimes these pipes are in the walls very near the opening of the inlet, where the air enters the room. Sometimes they are placed in rooms in the basement and warm the air for several classrooms.

At one time the indirect system was highly recommended for heating schoolhouses, but it was found difficult to keep the rooms warm enough by this method alone. Radiators were then added underneath the windows, and the combination of flues and radiators was described as the direct-indirect method. This is now one of the commonest forms of heating for larger school buildings.

Flues; use of windows. The building of the air flues is a matter over which there is great controversy. For example, Dr. Fletcher B. Dresslar, specialist in school hygiene and school sanitation for the United States Bureau of Education, says that the best position for the inlet duct is about eight feet from the floor, a little back of the middle of the inside wall opposite the windows. On the other hand, Dr. E. A. Winslow, Chairman of the New York State Commission on Ventilation, suggests that it will frequently be best to take advantage of the natural upward tendency of air which is being warmed by supplying cool, fresh air below

and removing the warm air above. Other authorities divide about equally between the two positions. In the same way very different directions are given for the size and shape of flues; although most of the authorities agree that large flues are more desirable than small ones, because they make it possible to admit large quantities of air without causing a strong draught. For the school superintendent the wisest plan is probably to secure the services of the best ventilating engineer available, and leave the question of location and size to his judgment.

In many of our modern buildings, equipped with elaborate heating systems and thermostats, there is an iron-bound rule that no teacher shall open the windows during school hours. Suppose, for example, that it is a very cold day and the teacher throws open the classroom window for a minute or two in order to get a breath of fresh air. Powerful fans downstairs are driving hot air into all the rooms of the building. When the window is opened one of several things may happen. A draught may be created, for example, and the stream of hot air which is rushing up from the fan may be carried straight across the classroom and out the window. The draught is so strong that this room gets more than its share of heat and the temperatures in other rooms fall. As soon as the temperature falls the thermostats in other classrooms start their mechanism into motion, so that more steam is turned on for all the radiators. Downstairs the fireman shovels in coal to generate more heat to take the place of the huge volume of warm air which is rushing out through the one teacher's open window.

Or again, suppose that instead of warm air going out through the window a volume of cold air rushes in. The teacher opened the window because the room was too warm; but, it has not yet had time to cool off. When the cold air strikes the thermostat it automatically registers and

acts, so that more steam is turned on to the radiators. The teacher now closes the windows, but the radiators are working even more actively than before and in a few minutes the room is intolerably hot again. As the heat increases, the thermostats become warm and the steam is turned off from the radiators. The teacher, however, finding the room quickly uncomfortable, again throws the window wide open, cold air rushes in, the thermostat becomes chilled, the steam heat is turned on in the radiators, and the same story is repeated over and over. No wonder janitors object when teachers open their windows in buildings equipped with the ordinary type of modern heating and ventilating apparatus.

Nor can one always blame the teacher if she feels that the regulation against opening windows is a useless imposition. One of the most frequent difficulties encountered with modern types of artificial ventilating apparatus is that the heat supplied to all the classrooms is at the same temperature. Classrooms on the north side of the building, which are naturally cold when exposed to the wind, need more heat than do those on the southern side of the building, where the sun pours into the room all day long. Often there is a difference of as much as five or ten degrees between the two rooms, but the heat supplied in each case is practically the same.

Contrary to the general belief, it is possible to construct buildings with modern apparatus so that the windows in any room may be opened without interfering with the heating and ventilating of other rooms. This is made possible by substituting for the old common-duct arrangement either the double-duct system or the individual-duct system. In both these latter systems the air for each room is individually regulated according to its need. Under the ordinary system there is a heating chamber in the basement where all the air supplied to the building is warmed and driven up

through one huge duct, which has branches connecting with each room. The double-duct system is built on the same plan, but under every branch carrying warm air into the room there is a second branch carrying cool air. At the base of each flue there are dampers, which are connected with a thermostat. When the temperature of the room falls, the thermostat acts so that the warm-air damper is open and the cool-air damper is partly closed. As the room becomes too hot, the warm-air damper is closed and the cool-air damper is opened. In this way the temperature of the air admitted to each room is regulated by the thermostat in the room, and is not affected in any way by the temperature of other rooms.

The most desirable, but also the most expensive, system has an individual duct for each room leading directly to the heating chamber. Arrangements are made whereby cool air and warm air are each supplied to the duct, and the proportion of each is controlled by dampers connected with thermostats in each room, as is the case with the double-duct system just described.

It is probable that in the near future we shall see many and interesting experiments with new methods of indirect heating. Dr. Bass, for example, has made some interesting experiments in Minneapolis, in which, instead of having large flues in the walls of the classrooms, he has supplied individual air inlets at each desk. On the other hand, some of our leading school architects have come out strongly in favor of doing away with all forms of indirect ventilation and depending solely on direct radiators and open windows.

Fans. When systems of indirect heating were first introduced, it was customary to rely upon the difference in weight between hot and cold air to produce proper circulation. Later it was found that the so-called "gravity" system worked well only when the difference between the outdoor

temperature and that of the air inside was very marked. In spring and summer, when the outdoor temperature was very mild, ventilation inside the building became increasingly less adequate, and even when windows were open, very little fresh air entered, because the pressure of the air outside was not heavy enough to force it in. In order to secure adequate circulation of air at all times it has recently become the custom to install fans which force the air through the rooms, regardless of its temperature.

There are two methods for using fans. One method is to suck the foul air out of the classroom, and thus create a vacuum which fresh air rushes in to fill. This is known as the "exhaust" method. The fan is placed either in the attic or in the basement. The exhaust method was widely in favor at one time, but its popularity rapidly waned. When the fans were placed in the basement, it was found difficult to make them work properly; when placed in the attic, the vibration of the machinery was unpleasantly noticeable. Moreover, it was found that when the foul air was drawn out of the classrooms, its place was taken not only by fresh air from windows and flues, but by foul air from corridors, basements, and toilets. Air rushed in from all available quarters, and it was very difficult to regulate its quality.

The plenum fan works on exactly the opposite principle. Here, instead of drawing foul air away from the classroom, fresh air is pumped into the room and drives the foul air out through pressure. The plenum system makes it possible to regulate the quantity, quality, and warmth of the air supplied to each classroom. Occasionally a combination of plenum and exhaust fans has been used successfully in school buildings.

Plenum fans are usually located in the basement, and air intakes lead from outdoors directly to a large, enclosed chamber. The fan placed at the opening of this chamber

draws the air from it and forces it up through the various ventilating flues throughout the building. The location of the air inlet is a matter of supreme importance. All too frequently it is either actually below the level of the ground outside, or else just even with it. This means that when the fan is working the air which is being drawn in from outdoors continually carries with it small particles of dirt, and unless there is some form of air-cleaning apparatus, this dirt is carried up into the classrooms for children to breathe.

Frequently, also, the air inlet is placed on the north or exposed side of the building. Few people realize the difference in the temperature of air directly outside the different walls of a building. In some cases it is said that there is as much as thirty-seven degrees Fahrenheit difference between the air on the north and the south sides of the same building in winter. During cold weather sometimes as much as a seventh of the entire fuel bill could be saved were the air inlet on the south side, where the incoming air had already been warmed by the sun. In planning the air inlet, then, care should be taken to place it high on the school wall on the southern side of the building. The air chamber should be kept clean and empty. It should never be used for storage. The fan should be enclosed in a fan chamber. It is not uncommon to find school fans, placed on the floor of the basement near the boilers, energetically pumping basement air into the classrooms.

Recently a distinctly new method has been used for school ventilation by means of fans. Instead of installing one large fan in the basement to supply air for all parts of the building, a small electric fan is placed in every classroom. This fan either draws warmed air up from the basement air chamber or cold air directly from outdoors, depending upon the way in which it is installed; and the air supply for each classroom may be controlled without affecting that of any

other. The fans are practically noiseless; and may be run without causing unpleasant draughts or interfering with classroom work.

Air cleaning. Reference has already been made to the danger of locating the air inlet near the ground, because it picks up dirt and spreads it by means of the fan throughout the building. Even where the intake is located high upon the wall the air frequently is found to be very dirty. This is particularly true in smoky cities, or in communities where the ground is dry and dusty. Our better school buildings are now installing apparatus whereby air taken into the building can be strained and cleaned of all the dirt it carried before it is sent into the rest of the building. This cleaning is either done by forcing the air to pass through cheesecloth bags, or similar dry strainers, or else by causing it to pass through streams of water which literally wash the dirt out.

Air-moisteners. If recent experiments furnish reliable evidence, it seems to be true that it is even more important to have the air moist than it is to have it clean. The problem of moistening air is a most perplexing one, and does not seem as yet to have been satisfactorily solved. Many different forms of apparatus have been devised, most of which are easy to install and simple of operation. The greatest difficulty encountered is that most of the successful air-moisteners are costly to run. Apparently the most successful and also the most expensive types are those which utilize the steam spray. Steam from the boilers is allowed to mix with the air which is being blown into the room by the fan. Although at times people complain that the air so mixed carries with it an unpleasant odor, it seems entirely possible to remedy the defect. The chief trouble with the system is that large amounts of steam are necessary in order adequately to moisten the air. This air is carried into the schoolrooms at high rates of speed, and is immediately forced out

through the foul-air flues into the outside air in order to make room for the large volumes of heated air which follow it. This means that the steam from the boilers is being constantly used up, and the fuel cost for doing this is very heavy.

There are many other forms of air-moisteners. For example, sometimes tanks of water are placed underneath the fan. Again, the air is forced through streams of water, which moisten and wash it at the same time. Sometimes sheets of porous cloth are kept constantly wet by sprays of water and the air is forced through them. These devices work with varying degrees of success. Usually it is necessary to combine the water with the steam, or to provide hot pipes which raise the temperature of the water. The chief difficulty encountered is to make the air take up moisture fast enough as it passes up into the room.

Thermometers. Every classroom in the country should be supplied with a thermometer. Every teacher and every child should be taught how to read it, and what to think about the results it shows. The thermometer should be of large size and of good make. Small thermometers are difficult to read and frequently get out of order. In placing the thermometer care should be taken not to place it too near the window, nor, on the other hand, too near radiators or fresh-air inlets. Probably the fairest place in the room for hanging a thermometer is in the exact center, halfway between floor and ceiling. If it must hang on the walls the teacher should experiment to find out which particular location will most accurately record the average temperature of the room.

Thermograph. Better than a thermometer is the thermograph, which not only shows the degrees of heat in the room, but also registers the findings in the office of janitor or principal. It is strongly desirable that the janitor should

be able to tell the condition of heat in each of the classrooms without having to make a personal visit. Thermographs can be installed at moderately low cost, and will be of immense help to the janitor.

Thermostats. The thermostat is an instrument which is installed in each room, and is so arranged that it automatically regulates the supply of steam to the radiators in that room. It regulates heat, not ventilation. Complaints are constantly made that thermostats get out of order. Where buildings are properly constructed, however, with the double or individual system of fresh-air flues, thermostats render excellent service. They take responsibility for heating classrooms from the shoulders of both teacher and janitor and make it an automatic matter.

Humidostats. The humidostat is similar in principle to the thermostat, except for the fact that it registers the amount of moisture in the air rather than the temperature. When the classroom air becomes too dry, the humidostat automatically turns more steam into the fresh-air flue. When the moisture becomes too great, the heat is automatically turned off again. As yet humidostats are rarely found in public school buildings, but it is probably true that, as the importance of securing the proper degree of humidity is recognized by ventilating authorities, the humidostat will take its place beside the thermostat as an important and necessary part of school equipment.

Re-circulation. Probably the most significant of all the recent experiments in ventilating and heating problems are those already mentioned which were carried on by Dr. McCurdy in his Springfield, Massachusetts, gymnasium, and by Dr. Bass in a public school in Minneapolis. Both of these gentlemen investigated physiological and psychological results of re-circulating air. The results of these experiments in re-circulation seem to show that if air is properly

washed, moistened, and kept in motion, it can be used over and over again with amazingly satisfactory results. It seems possible to eliminate all objectionable odors. The air seems fresh and clean throughout the building, and students working in rooms where re-circulation is used frequently say that they prefer that atmosphere to that found in buildings where the air is supplied fresh from the outside. Careful psychological tests all give the same evidence, that students working in re-circulated air do exactly as good work and as much of it as students working in fresh-air rooms.

There is, however, one important point on which evidence has not yet been made public. The New York Ventilation Commission has recently discovered that where air is kept cool, moist, and in motion in experimental chambers, the amount of carbon dioxide and other gases present seems to have no measurable effect either upon physiological or psychological responses. Only one important effect of foul air has been discovered, but that is an extremely significant one. The commission has succeeded in demonstrating so clearly that it cannot be successfully controverted that foul air tends to diminish appetite, and that the amount of food consumed each day by students in fresh-air chambers is materially greater than that consumed by students in foul-air chambers. Results of this study at once raise a most important question with regard to the plan for re-circulating air in buildings. Does washing foul air remove its appetite-destroying properties? Does mixing ozone with foul air have any such effect upon it? If it can be successfully demonstrated that re-circulation has no undesirable effect upon appetite, it will probably mean that most of our large public buildings, including school buildings, of the future will be built so that re-circulation is possible.

Re-circulation provides exceedingly clean air to the class-

room because it is washed on every round, and whatever dust escapes the first washing is sure to be caught in the second. Air-moistening is accomplished with very small expense because very little heat and moisture are lost in the process. The chief saving, however, — and it is an enormous saving, — comes in the amount of fuel necessary to heat the building. Since most of the air is kept in the building there is very little loss of heat. The desirable elements of re-circulation are so large and the undesirable elements so few that further experiments concerning the effects of re-circulation upon appetite seem of paramount importance. If re-circulated air can be shown to have no undesirable effect upon appetite, it will be difficult not to agree with Dr. Gulick when he calls re-circulation "the ideal ventilation for school buildings."

What shall schoolmen do? After studying carefully all the articles and books which have been written on the subject of heating and ventilating, superintendents and members of school boards find themselves in a curiously unsatisfactory position. They read of many interesting experiments. They learn that most of the old theories of ventilation have been proved false. They learn of many new principles which apparently are in the process of being established. But when the town has to build a new school building, to be ready for occupancy within a year, the question of what is the most satisfactory type of heating and ventilating apparatus to install is apt to meet with a very indefinite and unsatisfactory answer. One architect says dispense with all artificial ventilation, rely simply on direct heating by radiators, and open the windows. Another goes to the opposite extreme and recommends the most complicated system of fans, strainers, and moisteners. A few of the most enthusiastic engineers believe that re-circulation solves the problem, and strongly recommend that

a re-circulation system be established in all new school buildings.

For superintendents and school board members who are actually facing the problem of erecting new buildings within the coming year, and who cannot wait to find out what conclusions are eventually to be reached by experts, we suggest the following plan: —

First, employ not only a competent architect, but a competent heating and ventilating engineer, and if possible have the two men work together in devising their plans for the buildings.

Second, ask the engineer if it is not possible to construct the building in such a way that one of several different plans of ventilation might be used. For example, if the building is piped throughout, direct ventilation might be used with window ventilation. Inlet and outlet flues could be placed in the walls, as is usual with indirect heating and ventilating, and space could be left in the basement where a fan might be installed. At the same time the building could be so constructed that outside air could be shut out and the air of the building re-circulated. In a building erected in such a way it would be possible to shift, with minor changes, from one system of heating and ventilating to another, depending upon the findings of those who are now experimenting with the subject.

It is probably true that new buildings are not being planned in this way, but it is also true that the skillful heating engineer, working in coöperation with a competent school architect, could devise a system which could be readily adapted to meet changes in theory. Many of our newest and finest buildings are being constructed of steel and cement in such a way that they may be expected to be standing and in good condition after perhaps a hundred years of service. Even the buildings which are not of mono-

lithic construction are expected to last for twenty or thirty years at least, and we may be sure that within this time methods of heating and ventilating will be radically improved. Anything which can be done to forecast possible changes and construct buildings so that they may easily be made when the time comes, will be a wise investment of time and money.

QUESTIONS FOR STUDY AND DISCUSSION

1. In certain schools steam cocks on radiators are left open, pans of water are placed on radiators, or water tanks are attached to stove or furnace. How valuable are such devices for humidifying the air? If a water pan is provided in the classroom, why is it that children's faces may become flushed and dry before the water has been noticeably evaporated?
2. Why is it that damp air seems hotter than dry in summer and colder than dry in winter?
3. If suffocation is really caused by inability of the body to throw off heat, why are people able to lie comfortably completely immersed in water of a hot bath for many minutes at a time?
4. What, if any, changes would have to be made in the laws of your State to permit an ideal system of ventilation to be installed in a school building?
5. What are the comparative advantages and disadvantages of the different types of steam boilers now commonly used?
6. Make a special study of ventilating flues, noting number, size, location, equalizing chambers, automatic control, legal provisions, costs, etc. What are your conclusions as to the most desirable type?
7. Outline a course of study of ventilation for janitors. What should teachers know about the subject?
8. Make a schedule for a heating and ventilating survey of a school system.
9. The theory of re-circulation has ardent advocates and bitter opponents. If it can be proved desirable it will effect amazing changes in school practice. On the basis of all the evidence you can gather, what are your own conclusions?

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Journal of Industrial and Engineering Chemistry. Files and current numbers, especially that for March, 1914.

Thorndike, Edward L., Ruger, G. J., and McCall, W. A.: "Effects of Outside Air and Re-circulated Air upon Intellectual Achievement and Improvement"; in *School and Society*, May 6, 1916.

The printed material on this subject is enormous in amount, and even a carefully selected list of the most important references would be too long to include here. The student is urged to look through the files of the heating and ventilating journals, and to refer to the card indexes at public libraries under the headings of heating, ventilating, air, atmosphere, etc.

CHAPTER IX

PROTECTING SCHOOLHOUSES FROM FIRE

Fire protection unpopular. Fire protection is a distinctly unpopular subject. Most people are naturally optimistic. They do not like to believe that danger threatens, and they would rather take chances than spend time and money for various forms of insurance. In the United States as a whole at least one school is burned or partially destroyed by fire every school day in the year. But as most schoolhouses are only open five hours a day and five days a week, most of these fires occur when schools are not in session, and therefore very few school children are burned to death.

Occasionally, however, a terrible tragedy occurs; the communities which have followed the policy of taking chances are shocked out of their previous indifference, and for a few brief months undertake drastic reforms in the building of their schoolhouses. The burning of the Lake View School at Collinwood, just outside of Cleveland, on March 4, 1908, was directly responsible for placing Ohio at the head of all the States of the Union so far as concerns fire protection legislation. The recent tragedy at Peabody, Massachusetts, aroused waves of popular agitation in the New England press, but neither Collinwood nor Peabody nor the other lesser tragedies has any great permanent effect on the popular attitude toward fire protection. Safeguarding public buildings is an expensive process. School boards are beset on every side with applications for increased funds. Building costs already seem prohibitive, and the addition of thousands of dollars to secure prevention

against loss of life which in all probability will not occur seems almost an official extravagance.

Fire-retarding. If there is not sufficient money to erect a completely fireproof building, slow burning or fire-retarding buildings may be erected which will, at least, give the children sufficient time to escape. Corridors and stairs may be made of fireproof material, and cut off from the rest of the building by fireproof walls. Throughout the building, wherever possible, metal furring or tiled linings should be used. Where wood furring is necessary, it should be stopped off by plaster at the floor and ceiling and midway between. Even metal furring should be fire-stopped, to prevent the spread of fire by draughts of superheated air or flaming gases. In some of the earlier forms of construction the hollow spaces between inner and outer walls furnished flues whereby draughts might draw the flames from basement to attic. Again, the semi-fireproof building should avoid all unnecessary wood. The old plan, once so popular, of covering the walls with sheaths of wood should be discarded. Instead, a very satisfactory corridor covering is made by hard plaster painted, or with burlap pasted upon it. Wooden cornices, picture rails, door trims, and the like, should all be avoided, because they not only give extra places in which dust may gather, but they provide fuel for possible flames.

Attics. Most modern school buildings are built with flat roofs. From a fire-protection point of view this is far more desirable than the old-fashioned pitched roof. The latter usually extends over the entire space of the school building. It is large and low. Unprotected wooden beams are near to the floor. Piles of old furniture, paper, records, and the like, are piled together in loose heaps. A window is usually placed at either end, and long distances stretch between, unbroken by walls or partitions. In case of fire the large

attic furnishes a flue through which a draught carries the flames up through the walls toward the top of the building.

In buildings already equipped with large, unbroken attics, one or more vertical partitions should be erected in order to cut off the draught. Stringent orders should be given that no furniture or paper of any kind is to be stored in the attic. No classes should be held there, and the door leading to the attic stairs should be permanently locked. The roof covering should be of tile or slate, embedded in a suitable roofing composition. After this in order of preference comes metal roofing over heavy asbestos paper, or composition gravel or slag. Wooden shingles should never be used on any school buildings.

Corridors. In the semi-fireproof building, stairs and corridors should be made of fireproof material and separated from the rest of the building by fireproof walls and doors. In buildings containing over six classrooms, stairs should be placed at the extreme opposite ends of the building, and one or more fire partitions erected on each floor between them, so that in times of fire the doors may be automatically closed and the stairways completely separated one from the other. These partitions should usually be made of wire glass with self-closing doors held open by fusible hooks, that is, hooks which are held by metal links. These links melt at about one hundred and thirty degrees Fahrenheit and release the hook and door to which it is attached. If the corridor is otherwise well lighted, masonry or wood sheathed with metal may be used as a partition, but wire glass admits light and yet is unbreakable during fire. If the windows of the corridors are within thirty feet of any adjacent building, they too should be made of wire glass, so that in case of fire from without the windows will withstand the heat and flames.

Care should be taken to keep all corridors free of obstruc-

tion. Lockers, pieces of statuary, drinking-fountains, and the like, if used at all should be placed in recesses, where they will not interfere with free passage along the corridor. It is usually the better plan to place all decorations in the corridors above the heads of the children along the walls. Bas-reliefs, framed pictures, and mural decorations are more desirable than large statues.

Assembly rooms. All assembly rooms should be built on the ground floor and provided with separate exits, which lead directly to the open air. In old buildings, where the assembly hall is in the second, third, or fourth story, at least two fire escapes should be erected leading from the assembly room, but placed as far apart as possible. These fire escapes preferably should be of regular stair form, following all the rules for school stairways, and enclosed in fireproof towers. It should be possible to empty the assembly hall in two minutes, without having the occupants pass through other parts of the building.

Doors. Doors of auditoriums, classrooms, vestibules, and the like, should invariably swing in the direction of outgoing classes. In case of panic, where doors are hung to swing inward, the crush of persons trying to escape may frequently jam the door so that it cannot be opened. Doors which swing outward usually give way quickly under pressure. If supplied with "panic-bolts," as should be done in the case of all outer doors, the heavier the pressure the surer they are to open.

From the point of view of fire protection the common method of designing wardrobes, with one door opening into classrooms and the other into the main hallway, is open to rather serious objection. It is said that in the case of the Collinwood fire the children became panic-stricken, and when teachers sought to prevent them from going into the blazing hallways by guarding the main classroom door, the

children escaped from their control by dashing through the wardrobes. There should be only one door by which pupils may pass from classroom to corridor. In buildings which are not completely fireproof there should also be direct access to fire escapes from every classroom.

Stairs. Every non-fireproof school building of over six classrooms should be provided with at least two stairways, situated at the extreme opposite ends of the building. Additional stairways should be provided as the number of classrooms is increased. These stairways should lead from the top of the building to the first floor, and should open directly to the outer air. They should never be built to discharge into the main corridor. Stairs should be built of fireproof material, such as metal or concrete. Marble, slate, or tile treads crack when too hot, and should never be used for stairs unless completely supported underneath by metal framework. Wooden stairs supported by metal should never be used because they are not fireproof. The stairs should be completely enclosed by fireproof walls of such materials as metal, concrete, or wire glass. Stairway doors, like corridor fire stops should be made of metal and wire glass and held open by fusible hooks. In case of fire the links holding these hooks melt and allow the doors to close, thereby isolating the stairway from flames. Windows lighting the stairways within thirty feet of adjacent buildings should be made of wire glass.

Width and handrails. The stairs should not be less than four feet nor more than five feet in width between strings. The four-foot width for elementary schools is preferable. Width is fixed at four feet to prevent a third line of pupils going down the center without handrail supports. Handrails should be provided on each side of the stairs, and should be continuous on landings as well as on the stair proper. In old buildings, where the main stairways are very

FIG. 18. FIRE DANGERS WHICH NEED ATTENTION

(*a*) A dangerous basement
(*b*) A fire trap of a stairway

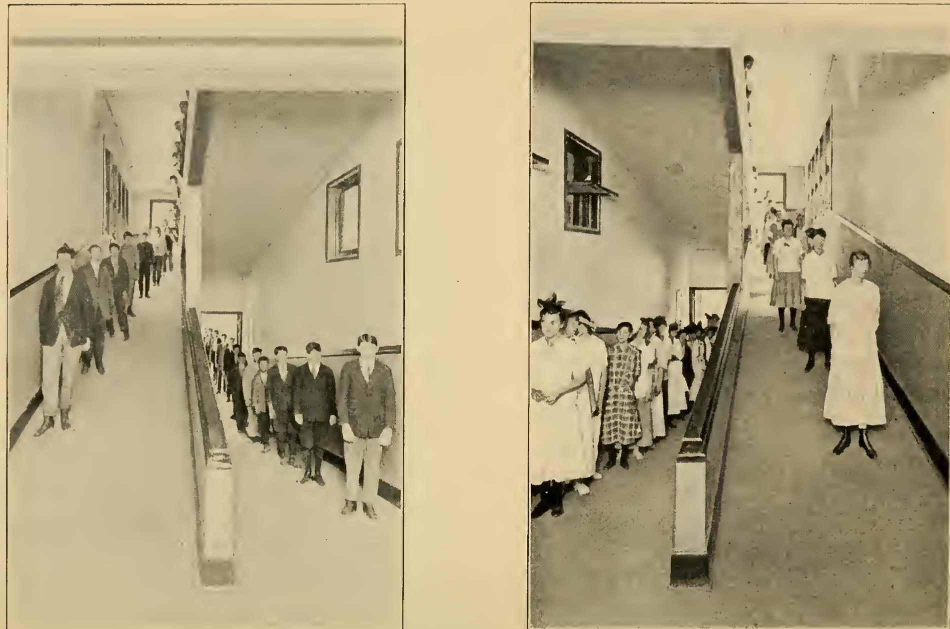

FIG. 19. AN INCLINE AS A SUBSTITUTE FOR A STAIRWAY

An incline or vamp in a grammar school at Woodland, California. (Through courtesy of the architect, H. H. Weeks, San Francisco)

wide, handrails should be inserted down the middle of the stairs. Wedge-shaped steps or winding stairs are extremely dangerous, and should never be used in the construction of stairways. In old buildings, winding steps may sometimes be replaced by platforms. If the winding stairway is over four feet wide, it may be rendered somewhat safer by moving the inner handrail several inches toward the outside, so that the part of the winder near the inner rail is at least as wide as a child's foot. This is only a makeshift, however, and should never be used unless other remedies have been proved impossible. Wedge-shaped stairs are perilous at any time, and during a panic they are almost sure to lead to serious accidents.

Landings. There should be at least one landing between floors, and at least three steps must intervene between landings. Where only one or two steps are provided, if the stairways are poorly lighted and the pupils are in a hurry, there is danger that they may fail to see the steps and may thereby be caused to stumble. Landings on stairways should be shallow, and provided with rounded corners. In old buildings, where the corners of the landings are square, there is danger that if a panic occurs the weaker children will be pushed into corners by older and stronger children, instead of being carried along with the crowd down the stairway. Square corners may be rendered safe by placing two wooden bars across them, parallel with the floor and about two and four feet above it. The stair landing is frequently clearly visible from the main corridor, and it has become the habit of many school authorities to place pots of flowers, ferns, or pieces of statuary on the main landing, so that they may be seen by the entering visitor. The artistic effect is frequently undeniably good, but unless these ornaments are set in recesses especially prepared for them, they place obstacles in the path of descending children. Every school

principal should remember "that obstructions cause delays, delays cost lives."

The stairways of old buildings are frequently their most dangerous features and also offer the most perplexing problem for reconstruction. Wherever possible they should be rebuilt of fire-proof material and isolated from the rest of the building by fire-proof walls and doors, as has just been described. Where this is out of the question, fireproof partitions should be erected across the corridors so as to cut off draughts, and commodious outside fire escapes should be provided in the metal stair or tower form. In buildings of the Collinwood type, where a large open hall extends through the center of the building from the first to the top floor, it is practicably impossible either to remodel stairways or to cut off draughts. In such cases ample fire escapes should be provided at once, careful fire drills should be instituted, and the school board should plan to tear down the building at the earliest possible date.

Exits. Stairs should lead directly to the outer exit, and the arrangements should be such that a line passing directly down the center of the stairway may be projected directly through the middle point between the two door posts. Where children have to turn just before reaching the doorway, their speed of exit is considerably retarded.

The floor of the landing at the foot of the stairway should be on the same level as the floor of the outer vestibule. The one or two steps frequently placed here cause stumbling. If the platform at the entrance is at some distance from the ground, outside stairways should be provided with fairly wide platforms; that is, fully as wide as the width of each door outside the vestibule. Stairways in the vestibule or leading from the vestibule to the ground should be the entire width of the vestibule. In old-fashioned buildings space is frequently left at the side of the doorway, and a corner

formed into which children may be shoved by their stronger companions. Where doors are so arranged the dangerous corners should be cut off by bars of wood placed across them, as was suggested in the paragraph dealing with stair landings.

The matter of cutting off corners is of greater importance than would at first appear. In the case of the Collinwood fire it will be remembered that the main entrance was to the left of the stairway instead of being immediately in front of it. Blank walls about two feet deep extended from each side of the doorway. When the alarm of fire was given, children on the first floor escaped, but some of them, eluding the control of their teachers, dashed back into the burning building in the hope of getting their coats and hats, which had been left in the wardrobe. As these primary children tried to hurry up the first flight of stairs they were met by descending groups of panic-stricken older children. Several of the smaller ones lost their footing and fell at the bottom of the stairway. They became crushed into the corners and against the walls, and their bodies formed a barricade over which other children tried to climb. It is said that even after the vestibule doors were forced open, the bodies of the children behind the main partition were jammed together one on top of the other so tightly that it was impossible to extricate them. It was at the foot of this stairway behind the vestibule partition where most of the one hundred and seventy-eight children and two teachers lost their lives. In Cleveland, the city nearest to the Collinwood disaster, the danger of unprotected square corners has been so strongly realized that in practically every old-fashioned school where square corners still remain wooden bars have been nailed across them in the manner just described, forming an inexpensive but effective protection against a repetition of the Collinwood disaster.

Railroad doors. The up-to-date school architect provides

his building with what are known as "railroad doors"; that is, single doors set side by side in separate frames. They are called railroad doors because they were introduced by large railroads in building their stations, where it was found that the old-fashioned double doors were inefficient and retarded egress. Double doors should never be placed in new school buildings. In old buildings they should be arranged to swing outward, and should be provided on each side with panic bolts or bars. The commonest form of self-releasing device is a bar which extends across the entire width of each door. When pressure of any kind is exerted upon the bar, it automatically draws the bolt from top and bottom and allows the door to swing outward. This is commonly known as a "panic bolt." It is not sufficient to provide one half of a double door with this panic bolt unless the other half is so arranged that it will immediately swing open as soon as the first half is released. It should be impossible to open only one half of a double door and leave the other half closed. The old method of keeping one half of the door bolted to the doorsill adds several feet to the width of a dangerous corner, and diminishes the exit space by half. Reliance should not be placed on the single bolt which turns by hand and draws top and bottom bolts. When children are frightened they usually cannot manage any but the most simple mechanism. Moreover, bolts of this kind frequently become rusted and are difficult for even an adult to open quickly. No matter what kind of a fastening is used, it should be impossible for any child to find himself locked in. Bolts should bar entrance, not exit.

Fire escapes. The very best form of fire escape is an interior, fireproof, well-isolated stairway. When people are frightened they rarely think about fire escapes or ladders; they rush for the entrance they commonly use. If the ordinary, everyday stairways can be rendered thoroughly safe

in time of fire there is little danger of panic. There should, however, be at least two, and in large buildings several, fireproof stairways, because there is strong likelihood that during a fire one or more of the stairways will be blocked.

Where the interior stairs cannot be isolated from the rest of the building and rendered fireproof, it is necessary to provide some form of outside stairway. Probably the most satisfactory form is what is known as the "Philadelphia tower," so called because it was first introduced in the apartment houses of Philadelphia. It consists of a large masonry tower on the outside of the building, but with separate landings on each floor connected with the different apartments by means of balconies. The stairs within these towers should answer in all details the requirements of modern school buildings. They should be fireproof, they should have handrails on each side, platforms should be placed between every story, and no wedge-shaped winders should be allowed. There is absolutely no excuse for using wedge-shaped steps in any form of fire escape. They are usually introduced in an effort to save space, but they are difficult to use at any time, and during a fire or panic are positively dangerous. The tower fire escape should begin at the top of the building, so that firemen may reach the roof easily in case of need, and should reach directly to the ground. It should be closed at the foot by a doorway with a panic bolt on the inside, but no handle on the outside.

The inclined-plane fire escape. There are various other forms of fire escapes on the market which utilize the principle of the inclined circular plane. A trough is usually enclosed in a tower of metal or masonry. Children enter from every floor, sit down on the trough and slide to the bottom. Too great acceleration of speed is prevented by the spiral twist. A chute at the bottom deposits the child safely on

his feet in the open air. The idea of the spiral fire escape is ingenious and may at some time prove valuable. They are used in many places with considerable degree of success. In other places, however, it is complained that the janitor uses the chute as a convenient receptacle whereby he may send waste paper and other articles from the top of the building to the ground floor. In one large public institution it was found that the laundress regularly sent down the bags of soiled linen. When a fire actually broke out one day the patients sliding down the escape were blocked at the bottom by heavy laundry bags. In other cases it is said that when the troughs are of metal they are not sufficiently protected from the weather and soon become rusty. As new and improved models are placed upon the market, the danger from these causes will probably decrease.

Essentials of a fire escape. The commonest form of fire escape is the metal stairway attached to the side of the building. This stairway should be provided with high protecting sides of wire fencing. It should have firm landings and solid tread and risers, so that children may be prevented from growing dizzy by looking down through open spaces. Handrails should be provided at each side, and should continue around the landings. A metal door should be provided at the base. It should be fastened with a bolt which has a handle on the inside, but none on the out. This means that the door can readily be opened by any one descending the fire escape, but access is closed to the intruder. All fire escapes should reach completely to the ground. The old method of leaving the fire escape with a platform about one story high, from which children are supposed to jump, or providing a swinging ladder weighted at one end which is suspended until the weight of the person comes upon the ladder, tends to produce panic in people already frightened because of an alarm of fire.

The fire escape should be readily accessible from every classroom without going into the corridor. It is allowable to have doors between classrooms so that the children of one may reach the fire escape by going through the next room. Escape should be provided on both ends of the building. Entrance to the fire escapes should be by means of full-length doors taking the place of windows within the classrooms. These doors should be covered with glass so as to admit light. The plan of having children climb through actual windows is decidedly bad, because it is a difficult matter and inhibits speed. Outside of every window should be a broad metal platform with a railing around it, so that there is no danger of falling. The stairs should lead downward from this platform in the same manner that stairs lead from any landing.

It should be exactly as easy to descend the fire escape as it is to go down the ordinary stairway. There should be no danger of dizziness, no feeling of insecurity. Metal ladders are almost useless, and should never be placed on school buildings. It should not be necessary to climb through a hole in order to reach the steps. Metal treads without risers should be avoided, because they lead to dizziness. A common error in placing fire escapes is to have them too near to the school building. The old form of ladder, already mentioned, usually clings to the wall itself. Many fire escapes pass directly in front of windows, and in case of fire flames are apt to break through the opening and encircle the escape. If a metal fire escape is provided it should be placed at least fifteen feet from the wall of the building. This is required in the Ohio code; it should be required everywhere.

Fire escapes such as those just described are unsightly. They cover large areas of the building with metal-work. They extend far out into the playgrounds. School boards will probably hesitate if asked to erect them. The tower

escapes, enclosing well-built fire-proof stairways, are much more sightly and should generally be recommended.

Basement. Most school fires are started in the basement. They are caused by over-heated pipes, defective furnaces, improper disposal of waste or ashes, smouldering matches, and the like. If the basement is rendered thoroughly fire-proof, the chances are large that any fire started there could be held in check for a sufficiently long time to enable all the children to escape. In old buildings it is considerably more easy to isolate the furnace-room from the rest of the building than it is, for example, to render the stairs fireproof. It is absolutely essential that the ceiling above the furnace or the boilers be covered with some fireproof material. The best method is probably to make a concrete flooring above it, but even metal sheeting will hold fire for a considerable space of time. If the floor over the boiler is of ordinary wood-joist construction, the joists should be filled in solid, with mortar or mineral wool, and the ceiling should be of thick plastering on metal laths wired to metal furring. A better plan is to make the entire cellar ceiling fireproof by substituting concrete for wood.

The walls about the boiler-room, furnace, and fuel-rooms should be of fireproof construction and solidly built, and there should be no general arches opening into the rest of the basement. Doors should be covered with metal and made self-closing. They should not be provided with hooks to hold them open, but should swing shut after any one passes through. Where possible all lights in the fuel-room and boiler-room should be electric, not gas or kerosene. Sometimes an unprotected gas jet extends into the room where coal is stored and remains a constant source of danger.

Special receptacles should be provided for ashes and waste paper. It seems self-evident to say that hot ashes should never be placed in wooden bins or barrels, yet there are

many schools where hot or only partially cooled ashes are actually disposed of in this way. Ash and paper bins should be lined with metal, and provided with metal covers; and arrangements should be made to have them emptied and contents removed from the building at least once a week. Cotton waste when used should be burned at once, and the main supplies should be kept in metal receptacles.

In building new schoolhouses it is desirable to erect the furnace-room, boiler-room, etc., in buildings completely isolated from the rest of the structure. This can best be done by making separate buildings with underground connections, but having entrance directly from outdoors instead of going through the main building. In any case the cellar stairs should be made fireproof, and a door covered with metal or made of other fireproof material should be placed at the head of the stairs.

Cupboards. In old buildings it is a common matter to find storage cupboards located under the stairways. There supplies are kept, such as raffia and other material for manual training. Books and paper closets are sometimes so located. In other instances cupboards under the stairs are used as wardrobes for children's wraps. Sometimes the janitor uses these places to store his supplies, oils, waste, sweeping compounds, etc. It can safely be said that no cupboard should ever be located under any stairway even in fireproof buildings. In old buildings where they are already so built they should be lined with metal, and used only for non-inflammable materials. If there is any danger of their being used in any other way the cupboard should be closed and kept locked.

Special care should be taken in the matter of storing waste, oils, raffia, etc. Fires frequently start in cupboards where these materials are stored, and gain a fierce headway before they are discovered. Storage-rooms for inflammable

material should be rendered fireproof by masonry walls or by metal lining. It is not infrequent to find, even in the best large city systems, schools in which the janitor stores his small supply of coke for starting the fire directly under, and in fact touching, wooden stairs leading to the main part of the building. Such criminal negligence should not be allowed, but it can be prevented only by careful supervision and instruction.

Manual training and domestic science. Manual-training and domestic-science rooms are especially apt to be the scenes of fire, because in the former case there are large supplies of lumber and sometimes paints and stains; in the latter gas stoves, coal ranges, stores of fuel, and the like, are apt to be carelessly handled and result in fires. Both these rooms should be provided with fireproof ceilings, and in non-fireproof buildings with direct access to fire escapes. It is usually better to place these rooms in the basement or on the ground floor and give them direct outside doorways. In a domestic-science room it is also important to see that small supplies of coal and wood, if kept in the room, are placed in fireproof boxes. Large wooden boxes lined with metal make satisfactory receptacles.

Pipes and wires. The Collinwood fire was probably caused by a steam pipe resting on a wooden joist. Steam pipes should be properly protected. Whenever they pass through partitions or over wooden joists they should be bound with a special covering or the wood itself should be protected by metal or some other material. It is not enough to have the steam pipes just escape touching the wood. As a matter of fact, a small area between wood and pipes is somewhat more dangerous than to have the pipe actually resting firmly against the wood. Unless a space of at least three inches exists between the two, careful measures should be taken to guard against fire.

Most modern city buildings are provided with electricity. This is considerably safer than gas if the wires are properly protected. In most cities regulations are such that defective wiring cannot be established with the approval of the lighting inspectors. Gas pipes are apt to leak. In old buildings, as the buildings settle, pipes are sometimes jarred apart, and the resulting small leaks are sometimes difficult to locate. Care should be taken, too, to make sure that the gas meter is properly supported. Sometimes, where the meter was originally carefully installed, changes are later made, and the meter left hanging without anything beneath to hold it firmly. In such cases leaks and explosions are exceedingly apt to occur. Wiring, piping, and heating should be carefully inspected yearly with a view toward locating possible sources of danger.

Sprinklers. It has already been suggested that most fires start in the basement of school buildings. One of the most effective means of preventing the spread of fire to other parts of the building is to install sprinkler systems in the fuel-room, boiler-room, and storage-rooms. As a matter of fact, could the expense be met, to install sprinkler systems throughout the entire school building would be a most effective way of preventing fire. In an old building where other means of changing the nature and location of stairs, establishing fire stops, etc., seem out of the question, a thorough system of sprinkler protection throughout the building may render it sufficiently safe to warrant the school board in delaying for a time the erection of a new building.

Each sprinkler head consists of a water pipe ending in a sprinkler and sealed with fusible metal. Under unusual heat these seals are melted and the water released. Usually the system is so arranged that the melting of any one of these seals causes bells to be rung all over the building. Water rushes through the sprinkler until shut off. In this

way the sprinkler is both an automatic fire extinguisher and fire alarm, and is one of the best means of fire protection. In order to install a suitable sprinkler system care should be taken to have the water pressure sufficiently strong and to protect pipes from freezing.

Fire extinguishers. In every building which is not completely fireproof chemical extinguishers should be placed in the boiler-room, in the storeroom, one at the head of the basement stairs, one in each domestic-science room, shop, and laboratory, and two on every floor of the building. The extinguishers should be recharged at frequent intervals, according to the directions given by the manufacturers. Fire hose, in lengths sufficient to stretch the entire distance of the building, should be placed on swinging racks on each floor and in the basement. In very large buildings hose should be supplied for each of the corridors. In rural schools, where running water is not available, fire pails should be kept filled with water on every floor.

Signals. Fire gongs should be so arranged that alarm can be given from every floor or from the basement. In many schools it is necessary to go to the principal's office in order to ring the alarm. This arrangement often means a decided loss of time. Where sprinkler systems are provided in the basement or other parts of the building, gongs should be arranged so that when the sprinkler heads are melted and opened alarm will be given in various parts of the building. Signal boxes or some other form of direct communication with fire headquarters, other than telephones, should be installed within the building on every floor.

Fire drills. Where school buildings are equipped with outside iron fire escapes it should be the custom of teachers on the upper floors to dismiss classes on clear days by having them descend the fire escape rather than the main stairway. This has the advantage of preventing congestion in the

corridors, and of accustoming the children to the thought of using the fire escape as an outside exit. In cases where children have not been regularly drilled in this way, panics often result from fear of trying an unfamiliar route.

The following directions for the organization of fire drills were taken from the bulletin published by the Division of Education of the Russell Sage Foundation in 1913, entitled, *Fire Protection in Public Schools:* —

Dismissal call: Three strokes of gong, repeated three times, with pause between each repetition.

Teachers go immediately to door and open it. Girls form line at rear of room, boys at front, ready to pass out together. All classes ready in ten seconds. Do not pause for wraps.

Janitor stands on first floor near front stairs.

Floor signals: One stroke for first floor, two for second, three for third. At one stroke, first-floor classes leave building rapidly by nearest exit. At two strokes, second-floor classes leave by nearest stairway. At three strokes, third-floor classes leave by nearest stairway. Classes pass down, two persons abreast, without hurry, crowding, or pushing, and out by nearest exit. Drill shall be so arranged that lines of pupils do not intersect. Teachers lead classes. Monitors march at end of line, and see that no pupils are left in classrooms. Each class starts downstairs when end of class in front reaches first landing. Pupils march directly away from building.

Other details: All doors shall be unlocked, and gates unlocked and hooked back, during school hours.

Principals shall see that fire escapes are cleared of ice and snow immediately after each storm.

Arrange signaling apparatus so that it can be sounded from every floor. Train all teachers to give signals.

Call fire drills at least once every two weeks. Have them occur without warning —

when exercises are being held in assembly room;
during any one of the recesses;
while all pupils are in classrooms;
when one or more exits may be supposed to be blocked;
where the peril may be assumed to be imminent to a particular part of the school.

Drills shall include frequent practice in descending fire escapes. Report every drill to school superintendent, giving form of drill, and time elapsed between first signal and exit of last person.

Fire protection pays. There are two parts to the problem of fire protection. In the first place, it is desirable to prevent flames from spreading; that is, to preserve property. In the second place, we must see to it that even though buildings may eventually burn down, no lives are lost in the process. We must retard the flames for a sufficient period to enable all occupants of the building to escape, and we must make special provisions against the danger of panic. It is the consideration of panic which bids us make straight stairways instead of curved, avoid wedge-shaped stairs, cut off dangerous corners, have doors opening outward, etc. For the purposes of retarding fire we use the metal ceilings and enclosures in the basement, fire walls on every floor, enclosed stairways, and the like. The following quotation, taken from the *Cyclopedia of Fire Prevention and Insurance* (vol. I, p. 67), brings home to us the necessity of providing quick and easy egress for all school children in case of fire. In many communities daily school attendance means daily danger of death: —

We average

3 theaters
3 public halls
12 churches
10 schools
2 hospitals
2 asylums
2 colleges
6 apartment houses
3 department stores
2 jails
26 hotels
140 flat buildings, and
nearly 1600 houses

burned up or partially destroyed EVERY WEEK IN THE YEAR.

Most schools built before 1900, and many built after that date, are not even fire retarding. To quote again from the Russell Sage Foundation pamphlet: —

The use of non-combustible material for exterior walls does not insure safety from fire. Wooden walls may blaze within a concrete shell as wooden logs blaze within an iron stove. In each case the flames are fanned by a draught. Draughts are dangerous. Isolate stair wells and air shafts by fireproof walls and doors. Cut the attic in half by a partition. Avoid draughts everywhere. Don't build your schoolhouse as you build a stove.

QUESTIONS FOR STUDY AND DISCUSSION

1. Suppose that a school board member argues that since no child in your town has ever lost his life in a school fire, and since schools rarely burn down, it is poor business to spend much money on fire protection, what would you answer?
2. Secure plans of the Collinwood school, and criticize from the point of view of fire risk.
3. Where it is proposed to cut long corridors by vertical fire stops, what attitude should be taken with regard to the objection that fire stops with automatically closing doors will materially retard speed in changing classes?
4. Study a building with wedge-shaped steps in one of the stairways, and make plans for rendering the stairway safe without changing the location or size of the stair well.
5. Outline a schedule for use in making a fire-protection survey.
6. Make a fire-protection survey of the buildings in your town. In making your recommendations keep the matter of costs in mind.
7. What is the difference in insurance rates between non-fireproof buildings with and without sprinkler systems?
8. Should teachers lead their classes in fire drills or follow them? What are the arguments on each side?
9. What is meant by slow-burning construction? How safe does it render school buldings? Are other precautions necessary?
10. How much more costly is a fireproof than a semi-fireproof building? What are the cheapest fireproof materials?
11. If only a limited amount of money is available for fire protection, how can it best be expended?
12. If the State or local fire inspectors have "passed" a school building in your town, is not this sufficient proof that the building is safe? Need the school board make any further study of local conditions?
13. What sort of State laws should be passed for fire protection in public schools? Who should make specific requirements? How should they be enforced? Should private schools come under the act? What about inspection?

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CHAPTER X

KEEPING THE SCHOOLHOUSE CLEAN

The janitor. The school janitor is at once one of the most important and least understood members of the educational staff. He is directly charged with maintaining hygienic conditions in the schoolhouse; such matters as heating, ventilation, cleaning, adjustment of school furniture, etc., rest upon his shoulders; and yet his work is for the most part unstudied and unstandardized. Not only do the qualifications of janitors vary immensely from city to city, but actually within the city itself janitors may range from rather ignorant men of all work to highly skilled engineers. Sometimes they are appointed on the basis of competitive or civil-service examinations, and sometimes appointment is made without any examination, but simply according to the whim of the school board. In a few cities there is a head janitor who has supervision over the others. In most communities, however, janitors are subjected either to no supervision at all, or else nominal supervision by some person in the superintendent's office.

In like manner the pay of the janitor depends upon no recognized principle, but in most cases varies from school to school according to some inherited plan. It is not at all unusual to find janitors with large heating plants and many square feet of floor area being paid considerably smaller amounts than janitors with simpler heating plants and smaller buildings. Some janitors are given assistants and others are not, and there seems to be no recognized basis for number of workers or hours of work. The whole question of the employment of janitors is seriously neglected.

If school buildings are to be properly run and cared for, each system should adopt for itself a minimum standard, below which new janitors shall not be allowed to fall. Qualifications of past experience, training, and the successful passing of practical examinations should be carefully outlined. Janitors already in the service who have not these qualifications should be given help and opportunity to improve their standing, and if unable to meet the new requirements after a fair interval should be eliminated from the system. A committee should be appointed to study the work of janitors in the various schools, and on the results of this examination a schedule of pay should be made up. In making this schedule probably the greatest weight should be given to the complexities of the heating plant. The most able janitors should be in charge of the most complex heating system, and should be paid the largest sum. Somewhat less important, and to be given somewhat less weight in fixing salaries, is the matter of the number of square feet of floor space. Some plan should also be devised for increasing wages from time to time, according to years of service and increased proficiency. Assistants should be provided so that the work that needs to be done can be done without unduly long hours or the use of extra labor. The actual number will usually be decided on the same basis as the amount of pay.

Provision should be made so that janitors already in service may receive training and education in matters of school hygiene. As is the case with the school teacher, janitors should be made to realize the professional importance of their work. They should be encouraged to meet in conferences to discuss various points of interest; they should be addressed by specialists in heating, ventilation, hygiene, and the like; they should, from time to time, hold joint conferences with teachers and principals, in order that each may understand the point of view of the other; and some

form of official recognition should be given by the superintendent and the board for exceptional service. The janitor's position is important. If he is to carry on his work successfully he must have the advice and interest of his supervisory officers, and should realize the importance of the task with which he is charged. The intelligent and efficient school janitor is one of the most successful allies of the school physician and the nurse.

How diseases are transmitted. Schoolrooms must be cleaned in order to prevent children from becoming sick. Unclean schoolrooms may produce illness in two ways. They may aid in transferring germs from one child to another, as is the case with diphtheria, scarlet fever, and the like, or they may themselves be the cause of physical disturbances. In this latter case, for example, the unwashed window may produce serious eye-strain; dust on a schoolroom floor may pierce the delicate lining of the lungs and bring about such a condition that tuberculosis may easily find lodgement.

There are many theories concerning the spread of disease. In earlier days it was thought that germs flew through the air from one person to another; and various fumigating preparations were used in order to fill the air with gases which would kill the escaping germs. Then again it has been thought that germs find their way to articles of clothing, furniture, wall-paper, and the like, and lodge there for long periods of time, varying from a few days to several months or years. For example, it was long considered true that the tuberculosis germ lodged in wall-paper or plaster of rooms in which patients had lived and so preserved the disease from month to month, with the result that houses became veritable death traps for new tenants. This second method of disease transmission by germs on articles over a considerable period of time is known as transmission by fomites.

The third and most recent theory of disease transmission is that germs are carried by direct contact; that is, either by one sick person touching a well person, or by new and still living germs being carried in particles of mucus, flakes of skin, or the like, from one person to another. In this latter case little time is supposed to elapse during the process of transmission.

The problem of transmission of contagious diseases is still in an experimental stage. Absolute results have not yet been secured, but in general it may be stated that the evidence points toward very little transmission by means of the air. It is noted, for example, that persons with different contagious diseases are frequently treated in the hospital in one large room, separated only by screens or cubicle walls. Were air transmission a common thing we should expect to have patients in these hospitals come down with many different contagious diseases. As a matter of fact, this very rarely happens, and when it does happen the explanation is usually easily found in some other source.

Modern science is also beginning to believe that transmission by means of articles of clothing, furniture, and the like, which have become infected several days or hours previous, is considerably less frequent than has been thought. It is pointed out, for example, that thousands of people use the books in the public libraries. Undoubtedly every year many hundreds of these books become infected by contagious-disease germs. Probably disease is sometimes spread in this way, but certainly such transmission cannot be general, for if it were we should have wave after wave of epidemics sweeping through the city, which could in time be traced to the public library. Similarly, very little disease seems to be transmitted by metal or paper money, although both are frequently contaminated by being carried between the lips, crushed in the hands, etc. Physicians do not deny

the possibility of transmitting disease by this indirect method. In fact, there are certain undeniable cases on record where diseases have been so transmitted. Anthrax, for example, has apparently been proved to be transmitted through hides and furs which have sometimes been packed away for many months. It is, however, increasingly apparent that disease transmission through fomites is exceedingly rare.

Stories are constantly being told of "scarlet fever rooms" and "tuberculosis death houses" which would seem to prove the frequency of fomite transmission, but upon careful analysis and examination it is found that the disease was actually contracted through direct contact. Bedbugs, for example, are believed to be responsible for keeping disease alive for months by living in cracks of the woodwork, and handing the germs down from one generation to another until, by passing them on to a susceptible human victim, they give to the house its grim reputation.

There are cases, too, of human "carriers" who, while apparently in the best of health, are actually the hosts of disease germs which thrive and multiply in their bodies and are constantly being given off in bowel or nasal discharge, and so spreading the disease among other people. Doctors are coming to believe that many of our most mysterious epidemics are spread by these human carriers, who, showing no sign of the disease themselves, are extremely difficult to locate. It is by contact transmission that most contagious diseases are spread, and it is against this form of transmission that the public school must constantly be on guard. For this reason medical inspection has established a system whereby children showing the preliminary symptoms of any of the common contagious diseases are immediately excluded on suspicion, and cannot return to the classroom until permission has been given by a physician. In this way the greatest

source of danger is immediately removed. When through some oversight a child who is in the early stages of contagious disease is overlooked and allowed to remain in the schoolroom, he becomes a source of danger to his companions.

In the old days of the common drinking-cup and the common towel contagious disease was passed from one child to another very rapidly, because the germs had no opportunity to die before the next child used the utensil. The life of the germ is usually very short, although there are some notable exceptions to the rule. Many germs are killed by a few hours' exposure to the sunlight. The chief danger in the classroom is that of immediate infection before the germs have had time to dry or become weakened. The most serious danger is the child who coughs and sneezes. Very many of the common diseases of childhood begin with such coughs or colds, and the germs are spread through minute droplets of mucus which are sprayed into the air. These tiny drops fall on the surrounding desks, floor, chairs, and the like, and may easily be transferred while still moist and alive to the hands and faces of near-by children. It is because of the very great danger of spreading disease by means of mucus that we insist that every schoolroom be so placed that it may be flooded with sunshine at least once a day. Sunshine kills germs faster than almost any other germicide.

Diseases are also probably very frequently spread through the common toilet. Toilets are often contaminated, even when children are taught to be careful. Germs are found upon the seats, walls, and doors of the toilets, and upon the handles of outer doors. It is because of the danger of contagious diseases that we have urged in an earlier chapter the supreme importance of providing wash-basins with hot water and soap near or directly outside the entrance door to every toilet-room. Were such facilities provided and inspection made sufficiently severe, so that all children

were forced to wash their hands after using the toilet, many of the contagious diseases of childhood would probably be prevented.

Prevention of contagious diseases. Contagious diseases may, then, be kept from spreading, first, by a careful system of medical inspection which excludes every child who shows suspicious early symptoms, and insists that he receive a physician's certificate of health before being readmitted to the classroom.

In the second place, epidemics may be prevented by flooding the classrooms with sunlight for a considerable portion of every day. It is a very common habit of the school janitor to pull down the curtains of the classrooms as soon as the daily cleaning is over, and leave them down until classes open the following morning. He does this partly from habit, and partly in order to keep his windows clean. In many homes the unused rooms are always kept darkened. One finds it this way, too, even in our best hotels. The practice has become traditional with housekeepers, chambermaids, and janitors. Dust, too, is apt to rise from the floor and settle on the windows, and drawing the shades keeps much of it off. It will probably be necessary to pass a rigid rule concerning this matter of drawing shades if the classrooms are to receive the proper amount of sunshine. Rooms facing the east should be open to the sunlight from very early in the morning until class time. Rooms on the west should be open to the sun at noon when the children are not there, and from the time school closes in the afternoon until sunset. During these hours the shades on the classroom windows should be rolled tight, so that the entire window is left free to admit sunlight. Daily exposure to the sun is of far more value than most forms of germicidal preparation. If janitors are provided with a sufficient number of helpers, so that they can clean the windows frequently, they will not seri-

ously object to this rule; whether they object or not the rule should be strictly enforced. It is one of the most economical ways of preventing diseases among school children.

Cleaning of schoolroom floors. Dust is one of the most dangerous factors to be considered in school hygiene. It was formerly thought that dust carried many pathogenic microbes. Dr. Alvin Davidson, for instance, is said to have collected more than one hundred million germs in the single sweeping of an ordinary schoolroom. The New York Committee on School Inquiries, on the other hand, found that while there are many bacteria in schoolroom dust, very few of them are harmful. The same committee came to the conclusion that "in a dry, well-lighted room, pathogenic bacteria live but a short time and do not propagate or multiply."

While it is probable that dust does not carry many virulent germs, it is generally agreed that dust is decidedly harmful because of the sharp particles it contains. Statistics show that there are approximately six times as many deaths from consumption and pulmonary diseases in the trades in which sharp dust is made as from the occupations of farming, planting, and raising cattle. This is because the sharp dust particles are breathed into the lungs. They irritate the membrane of the throat and lungs and frequently assist in spreading infection. Whether or not the tuberculosis germ is actually carried by dust is an undecided question, but it seems certainly to be true that tuberculosis flourishes in dusty trades. The lining of the lungs having become irritated, the tuberculosis germ finds a ready reception. Tuberculosis is the cause of death more often among teachers than among workers in all the other fields together. Moreover, it is commonly estimated that between one third and one half of all school children have tuberculosis at some time during the school period. This probably means that schoolroom dust is

largely responsible for the high tuberculosis mortality. Most of the classroom dust settles upon the floor, and therefore methods of cleaning schoolroom floors are particularly important.

Most classroom floors are made of wood. When properly selected and laid, wood takes a good polish, is not excessively expensive, holds screws of chairs and desks firmly, is pleasant to walk upon, and is easily cleaned. If wooden floors are of soft wood and are poorly laid, they wear out rapidly. Under frequent washings the wood shrinks, and leaves cracks in which dust may gather. It is apt to break into sharp splinters, and once having become broken it is very hard to keep clean. Wooden floors should be of hard wood, straight-grained, and free from pitch, rosin streaks, or other defects. Well-seasoned oak is probably the best wood for schoolroom use. Hard maple is good, and hard pine is also in favor. The boards may range from two to two and one-half inches wide; but they should not be wider, because it is difficult to lay them properly in wider widths. Boards should be carefully matched so that no cracks are left between them, and nails should be inserted in such a way that the wood is not marred and holes are not left. Merely to select good material for floors is not enough. Careful supervision should be exercised over the workers as the floors are laid. Improper laying or nailing will cause trouble for years afterward.

There has recently been noticed a distinct tendency to use linoleum for schoolroom floors. Cheap grades of linoleum wear out quickly, show marks, and are expensive. A good quality of battleship linoleum, treated with preservative and glued permanently on a cement surface of concrete construction is quiet, non-porous, and almost indestructible. However, it will not hold screws and therefore cannot be used for the regular fixed furniture. Where furniture is

not fastened to the floor, linoleum is an excellent covering, is easily cleaned, and is not excessively expensive. Cement floors are hard, cold, and will not hold screws. They are undesirable for classroom purposes. Cement may, however, be used as the floor base if it is covered with wood or with linoleum.

The floors in many of the newer buildings are being laid in what is called "hospital construction"; that is, the joining of the floor and wall is curved rather than made a straight corner, so that dust cannot collect there. When carefully made such construction is excellent. In most cases, however, it is found that this joining is poorly made. The wood shrinks away from the floor and deep grooves are left which quickly fill with dirt. Careful supervision is needed in order to have this feature of hospital construction an advantage rather than a defect.

Sweeping and dusting. Dry sweeping is the most common method of cleaning schoolroom floors. Brushes and brooms are used to gather the dust into piles and it is then picked up and carried away. The difficulty with dry sweeping is that it stirs up dust and does not remove it. With each stroke of the broom dust is whirled into the air in large quantities. There it floats for a time, and as the air becomes quiet the dust gradually settles down upon floors and furniture as it was before. In the same way the common method of dry dusting with cloths or feather brushes is ineffective, because it usually stirs up the dust, but does not remove it from the room. The feather duster is particularly undesirable and should be prohibited.

One of the best ways to sweep floors is to use some preparation which will catch the dust. For example, if sawdust, mixed with water sufficiently to make it slightly damp, is sprinkled on the floors in sweeping, the little particles of sawdust will gather the dust and hold it so that it may be

gathered into a pile. This is the same principle as was used by our New England mothers when they sprinkled damp tea leaves on the carpet or on cold mornings brought in large handfuls of snow, sprinkled it quickly over the floors, and swept it up before the heat of the room could melt it. In each case the purpose was to make the dust sufficiently damp so that it could not rise in the air, but could be swept into small heaps and could be carried away. There are many so-called dust-absorbing compounds on the market. These are usually made with a basis of sawdust or paper, mixed with water, oil, wax, salsoda, chloride of lime, sulphonapthol, formaldehyde, carbolic acid, or sand. Some of these preparations are very expensive, but with a little ingenuity a home-made preparation may be manufactured which will be really satisfactory.

According to general instructions a few handfuls of the sweeping compound are thrown on the floor and then pushed from place to place, so that the entire surface is gradually covered by the compound and broom. As a matter of fact, it will frequently be found that janitors who are using the compound do so in a most haphazard manner. Long halls and corridors are usually fairly well swept in this way, but in classrooms, where there is fixed furniture, janitors complain that small piles of the sweeping compound are apt to gather around the legs and standards of the furniture. This difficulty is, in fact, so serious that only a few of the most conscientious janitors actually use the sweeping compound in any effective manner when sweeping classrooms.

In dusting, as in sweeping, it is desirable to secure some method whereby the dust can be weighted so that it will not fly out into the air during the process. Instead of using the feather duster, then, woolen or cotton cloths may be secured and slightly moistened either with oil, wax, or water. Care should be taken not to make these cloths too wet,

because in such a case they will leave streaks upon the blackboards and furniture. Dusting cloths should be barely damp enough to catch and hold dust. Most of the dustless dusters now sold in the department stores are prepared in this way. A piece of cheesecloth is dipped in some oil preparation, and then allowed to become nearly dry. Enough oil remains in its meshes to catch and lay the dust.

Scrubbing and care of floors. A few years ago it was universally believed that the only effective way to clean a floor was by a general application of hot water and soap. Much of the janitor's time, and usually much of the time of his wife also, was spent on hands and knees scrubbing the schoolroom floors. It is probably true that water and soap are effective removers of germs and dirt. It is also painfully true that most washing is not especially effective. This is particularly the case in old schoolrooms, where on account of previous washings the wood has become swollen, and then has shrunk so that it leaves large cracks between the boards. In future scrubbings the muddy water trickles down between these cracks, and there dries and leaves cakes of mud; so that it is a fairly common thing in old, badly cared-for buildings to see little clouds of dry dust spring up from between the boards whenever persons walk across the room. Washing has a very bad effect upon most wooden floors. It widens the cracks and usually causes the wood to roughen, so that large splinters appear. There are many different compounds recommended for use in washing floors, such as various washing-powders, soda, ammonia, sulpho-napthol, formaldehyde, oxalic acid crystals, hard soap, soft soap, muriatic acid, and coal oil. There are doubtless times when the use of some or all of these preparations may be desirable.

It is common in schools, where floors of classrooms and corridors are oiled or waxed, to find a rule demanding that

floors of kindergartens and gymnasiums be washed daily or weekly. This rule is usually made in order that floors may not be slippery, so that the children will not fall, and so that in the kindergarten children may sit down upon the floor without soiling their clothes. So far as the latter objection holds, it is true that the common method of oiling floors with heavy thick oil is harmful to clothing, but when carefully done oil and wax may be applied in such a way that they will leave no stains even upon clean white handkerchiefs when passed along the surface of the floor. In the gymnasium it should also be noticed that when the floors are washed they frequently leave the small muddy deposit just described. This means that when exercises are carried out upon these floors small puffs of dust are constantly arising and entering the lungs of the students. If very carefully applied, the lighter forms of oil may be used in gymnasiums without making the floors slippery.

Use of oil and tar. There can be little doubt that oil and wax properly applied make the best finish for schoolroom floors. This does not mean, however, that all rooms where oil has been tried have shown better results than the ordinary scrubbed wood floors. When the plan of using oil first came in, the commercial product was a very heavy, dark oil, thick and rather sticky. When generously applied to the floors, this oil immediately made a most unpleasant surface. Teachers complained that their skirts and the skirts of the older girls were seriously stained and soiled around the bottom. The dirt of the schoolroom was ground into the oily surface until it formed a thick and unpleasant layer upon the floor. Footsteps of children walking back and forth were clearly shown upon the surface. In many communities the unpleasant results of early oilings were so serious that any suggestion of using oil will even now bring most emphatic protest from teachers, principals, and janitors alike.

The oil selected for schoolroom use should be a light oil, of rather thin consistency. Most light oils may be applied in either of two ways. They may be spread over the floors by means of a brush holding an oil reservoir or they may be sprayed over the floor by an atomizer. Before the first application the schoolroom floor should be thoroughly washed and dried. The oil should then be applied to every part of the surface in a thin layer, and thoroughly rubbed in with woolen cloths. After this the room should be closed, and if possible the floor should not be used for from five to ten days. This means that such a first application must be made either in the summer, Christmas vacation, or the spring holidays. Even when heavy oils are used, if they are applied very sparingly and well rubbed in, most of the trouble connected with them will disappear.

After the initial oiling water should never be applied to the floor. It will usually be found that the dust on the floor gathers to itself just enough oil to keep it from rising; that is, it acts as a dustless sweeping compound. The dust so weighted may be gathered in a pile by a soft bristle brush, easily collected, and removed from the room. It is frequently found desirable to use the lighter oils in connection with a spray about once a week, very sparingly in each room, so that a little of the oil sprayed into the air descends upon the floor and acts as an additional help in weighting dust.

In some European countries floors are covered with a thin preparation of tar instead of oil. Tar catches the dust in much the same way that the oiled floor does. It is easily cleaned, cheap, and antiseptic. It is very easily applied, since it is merely coal tar laid on thinly while hot, and allowed to cool. The chief argument against the use of the tarred floor is that it is dark, unpleasant to look at, and frequently has a disagreeable odor which lasts for a long time.

Cleaning walls and blackboards. It should be possible to wash the schoolroom walls. Such washing is rarely necessary, but, especially when contagious disease is present, may sometimes be desirable. Usually dustless dusters such as those already described may be used on the parts of the walls within ordinary reach. Such dusting should be done about once every month.

Blackboards are best cleaned by dry erasers of good quality. They should usually be washed only when the marks of chalk cannot be removed in any other way. Frequent washing hurts all but the very best grade of slate or glass blackboards. When boards are washed, they should be quickly rubbed dry with a woolen cloth. A very slightly dampened square of cheesecloth will often be found effective in removing the gray appearance left by chalk. Real washing need only be rarely resorted to, and soap should never be used because it leaves an oily surface upon which the chalk will not write. Chalk trays should be cleaned twice a day in rooms where the boards are frequently used. The chalk should be carefully collected from the trays by means of dampened cloths. At the end of each school day the erasers should be removed from all classrooms and cleaned. Such cleaning should never be done in the old-fashioned method described in an earlier chapter, by which children are given the privilege of cleaning erasers as a reward of merit, and when school is over stand by an open window beating erasers together, two and two, with the chalk dust blowing straight back into the room and into the lungs of the pupil. There are many mechanical machines on the market in which erasers can be placed in large quantities and rapidly cleaned. For all but the smallest and most poverty-stricken schools it is exceedingly desirable that some such machine be secured. If erasers must be cleaned by hand the work should be done by an adult person

outdoors, and at a considerable distance from the schoolroom.

Keeping toilets clean. Since many of our most serious disease germs are found in toilet-rooms, the cleaning of these rooms assumes particular importance. This would be somewhat less true were toilet-rooms built as they should be, facing the south and exposed to the rays of the sun the greater part of the school day. Unfortunately it has long been the rule, and still is in many places, to put the toilet-rooms in that part of the basement which is not wanted for other purposes. All too frequently the toilet-rooms face north and have such small windows that even were the sun on that side of the building, the rays would rarely be admitted. The walls of the toilet-room should be made so that they can be washed down with hose. This means that all toilet-room walls and ceilings should have a glazed surface; and that the floor of the toilet-room should slant in such a way that water will readily run off into a drain. If toilet-rooms are so constructed, it will be a comparatively easy matter to wash down walls, ceilings, and floors with a hose once a week.

The toilet fixtures themselves should receive much more frequent attention. It is probably not too much to demand that at the close of every school day the toilet-seat, the handle of the toilet-door, toilet-chain, and handle of the main door leading to the toilet-room should all be washed with a germicidal preparation, such as carbolic acid, formaldehyde, or the like. It is in the toilet-room more than in any other part of the building that virulent germs are freely deposited on surfaces likely to be touched by other children and unexposed to the germicidal properties of sunshine and air. Until toilet-rooms are properly built, their cleaning should receive exceedingly careful attention.

Other parts of the building. Where oiled floors are used

the desks and chairs of each classroom should be dusted once a week. In cases where dry sweeping is still the method, such dusting should occur after every sweeping. Halls, entrances, stairs, and cloak-rooms should all be swept at the close of each day. Sewing, cooking, manual-training, and other rooms where special dirt is likely to occur should be swept after each class period. In some cases this work is profitably attended to by the students in the classes.

Special care should be taken in the open-air classes with children who may be affected by the first stages of tuberculosis. Receptacles should be provided into which these children may spit, and special care should be taken to see that the room is flooded with sunshine each day.

In cases where contagious disease has been discovered in the classrooms, it is probably well to wash the surrounding floor and the desk and chair with an antiseptic solution before allowing any other child to sit there.

Cleaning the windows. It is almost universally true that schoolroom windows are not washed with sufficient frequency. When we think about the importance of lighting in the classroom, we must realize that it is of little use to provide specified amounts of glass area as compared with floor area, unless that glass be kept clean after it is put in. In most systems it is the custom to wash windows three times a year. This is rarely enough. The actual rules must vary with the locality. It is entirely conceivable that in certain of our most smoky manufacturing cities the class-room windows should be washed on the outside every day; and it is certainly true that in most cities and towns windows should be washed at least every two weeks. If it is suggested to the average janitor that windows be washed with any such frequency, he will at once violently object. It is hard enough for him to keep the fires going in winter and to sweep the floors every day without having this extra and

exceedingly tedious job added to his routine. The fact that the janitor objects, however, should be reason not for allowing windows to go dirty, but rather for providing a sufficient number of helpers so that they may be cleaned without undue hours of labor on the part of any of the school employees.

Vacuum cleaners. It is only within the past few years that the vacuum cleaner has become serviceable, durable, and comparatively inexpensive. At the present time cleaners are on the market which do their work so effectively that they may be regarded as exceedingly desirable for all new school buildings. As is the case in the discussion of oiling schoolroom floors, much of the opposition to the vacuum cleaner has arisen because either the tools provided were poorly constructed or else the janitor has not been taught how to use the machine. The arguments in favor of the vacuum cleaner are in general these: When properly installed and of good type such cleaners remove the dirt entirely from the rooms instead of allowing it to stay and settle back after the air has become quiet. They do not stir up dust during the process. The room need only be cleaned once. No dusting need follow. Walls and ceiling may be cleaned without marring the surface, and without the stain which often comes with the use of soap and water. Where floors are old and cracks are wide, the dust may be removed from cracks and crevices, as well as from the outer surface. Vacuum cleaners can and should prove a great saving to the school janitor. As experimentation continues and new tools are devised especially for classroom purposes, this will become increasingly true.

Types of vacuum cleaners. There are various types of vacuum cleaners, but all may be divided into two general groups, the portable and the stationary outfits. Portable machines are designed to be operated by hand, or by small

motors attached to the electric light socket. The former are especially recommended by manufacturers to the school committees of rural districts, where the schools are not furnished with electric light systems and cannot very easily run their own dynamos. In general it may be said that, while there are a few possible exceptions, most vacuum cleaners of the portable type are neither durable nor effective. They are apt to return the air only partly cleaned to the room from which it was taken. Usually they have not sufficient suction power to pick up all the dirt on the floor.

Stationary outfits are usually more expensive than the portable. They must be installed in the lowest story in the building, and the building must then be piped throughout. This means that it is very difficult to install a stationary outfit in old buildings. The exhaust of the stationary vacuum cleaner is usually through the main chimney. A powerful electric motor or other driving mechanism runs the vacuum-producing pump. The pump draws air through pipes containing filters for straining out the dirt. Exhaust air is drawn into the chimney. At regular intervals the heavier dirt which is collected is removed from the tank by hand. Cleaners vary from one sweeper to twelve sweepers or larger, depending on the number of men who can work at once. Most schools need only a one- or two-sweeper plant.

While vacuum cleaners vary widely in particular designs they usually belong to one of four distinct types. The first is the turbine type. Here suction is produced by one or more disc fans or propeller steel blades mounted on a shaft, with baffle plates between the blades. The whole is enclosed in a cylinder. Such a pump runs at very high speed, and sucks the air through much on the screw principle. The dust is separated by centrifugal force. These pumps are very simple in construction and durable, but must be run at high speed.

The second type of pump is known as the rotary pump.

It is very similar to the turbine in general principle. An eccentrically mounted shaft is provided with oscillating blades, and the whole is included in an outer casing. It is possible to run the rotary pump at very low speed and secure strong suction. However, it has many bearing surfaces and is liable to injury. Cleaners of this type are usually fitted with fabric bags for dust separators, which become clogged, tear, and otherwise interfere with the working of the pump. Water filters are sometimes added, and are very effective, but also expensive and apt to get out of order.

The third type of vacuum cleaner is provided with a piston pump. Instead of screwing the air around and around, this pump rather draws it up; that is, it has a reciprocating rather than a rotary motion. Piston pump cleaners are usually very complicated and expensive. They are highly efficient, but apt to get out of order. There is need for a single-acting piston pump of simple valve design for one-unit sweepers in the smaller schools, but at present such a plant is difficult to secure.

The fourth type of vacuum cleaner is on the principle of a steam injector. It is very simple, and there are no moving parts. Where steam is always available at ordinary pressures for power purposes, the steam injector cleaner produces satisfactory results. Where steam has to be especially generated for the purpose, however, it becomes too expensive for ordinary school use.

Much of the success of a newly installed vacuum cleaning plant depends upon the skill with which pipes are inserted within the walls of the building to reach the various parts. It is not an uncommon thing to find, for example, even in new buildings, that the cocks to which hose can be attached for vacuum cleaning are only two in number, and placed at the extreme ends of the corridors. This means that in order to clean rooms along the sides it is usually necessary

for two men to work at one time, one handling the nozzle and the other helping to carry the long length of wire-wound hose. Piping should be so designed that every part of the building is within fifty feet of a hose outlet, so that no section of hose will be too heavy for one man to handle alone. The pipes should be arranged in vertical risers with few horizontal runs, with long sweeps of drainage fittings having shoulders of smooth hose. Even slight roughnesses on the inside of the pipes will cause clogging and render the cleaning service inefficient. Pipes should never be less than one and a half inches in diameter.

Hose sections should be from fifty to seventy-five feet long, about one and one-quarter inches in diameter, and should be stiffened with spiral wire, because otherwise they are apt to collapse with the force of suction. Air-tight couplings should be provided.

Tools for vacuum cleaning. For cleaning bare floors tools should be from ten to eighteen inches long, and about three inches wide. Felt pads or bristles prevent too great admission of air and localize the inrush. Circular brushes with long bristles and a leather cuff will frequently be found useful for cleaning walls and chalk trays. New tools are constantly being invented, and careful experiment should be made before final decision. There are, for example, tools on the market which are self-propelling, so that the janitor is able to stand at the front of the room and direct the brush in such a way that it travels to the back of the room and returns to where he is standing. Such devices as this make it possible for the janitor to clean rooms very much more speedily than would otherwise be the case. In choosing tools for vacuum cleaning care should be taken to see that the clear opening through the tool is not less than a half square inch, as suction at the operator's handle through this size opening should be not less than two inches of mercury.

Suggestions for improving service. Before any striking changes can be made in the quality of janitorial service it is necessary that a careful study be made of the school plant, in order to see what changes in materials and equipment would make the janitor's work easier. For example, in buildings already supplied with high-pressure vacuum cleaners it is at times possible to provide a vacuum attachment to the boiler, so that the boiler tubes may be cleared out by vacuum power rather than by hand. Where the equipment is such that this is feasible, an immense amount of work is immediately saved for the janitor. In other cases, changing the location of the coal bin, providing carts on wheels, cranes for carrying heavy loads of coal, ashes, and the like, providing a direct exit from the boiler-room to the outside air, so that ashes may be carried out with the least difficulty, and other similar small changes may be made at a comparatively low cost.

It is also usually possible, by erecting partitions and sometimes increasing window space, to board off a small office or room which shall be designed for the janitor's own use. The number of hours during which the janitor is nominally on duty are usually, at least during the winter, very long. He is not actually busy with the fires during all that time, yet in practically all of our old schools and many of our more modern buildings it is the custom to assign to the janitor only the cleared space around the boiler, with a hook on which to hang his coat. In most systems the school janitor has many other duties besides merely tending to the heating of the school building. He has to receive supplies, admit workmen to the building, keep account of the number of hours they spend on the job, and do various other clerical tasks. He should be provided with a personal office, preferably opening off of the boiler-room, in which should be a desk or table at which he can keep his accounts, and some

place where documents may be filed. This question has already been discussed at some length in an earlier chapter, but should be emphasized again. It is of little use to try to teach janitors the importance of their jobs, unless we first provide them with comfortable and dignified quarters.

Careful study should be made of the different utensils and materials which can be used in janitorial work. Too many janitors are treated in a way similar to that to which the wives of unprogressive farmers are so frequently subjected. It is proverbial that much of the work on the farm done by women includes large amounts of unnecessary drudgery, simply because labor-saving machines which are on the market are not purchased. It is too often true that even when janitors hear of interesting devices which might cut their labor in half, they hesitate to speak about them, because the tradition has been established that requests from janitors are not attended to. Such an attitude makes for inefficient service.

As is the case with teachers and most other laborers, janitors need careful supervision. They cannot be expected to run a well-organized system without adequate leadership. In large systems the janitors should be united in a department, with a good supervisory officer at its head. In small systems supervision of janitorial work must often be combined with other duties, but supervision of some sort there must be if efficiency is to be gained.

Daily cleaning schedule. In most school systems there is some form of daily schedule for the cleaning of school buildings. Directions are given for the frequency with which floors shall be washed, oiled, or swept, windows washed, door-knobs, stair rails, and woodwork cleaned, walls brushed down, toilets cleaned, and so forth. These schedules vary greatly in requirement and in the amount of specific instruction provided. It is undoubtedly desirable that such

a schedule be adopted for each school system, but it should not be imposed from the top, except for certain minimum requirements. The janitor may properly be instructed to sweep the classrooms each day, but whether he shall do that in the morning, at noon, or at night is probably best left to his own decision. Wherever possible the schedule of cleaning work should be planned and adopted by the janitors themselves working in concert. It will sometimes be necessary to lay down certain rules which must be followed, but the more the janitors participate in making these rules the greater will be their interest in following them.

Conferences and study courses for janitor. When the efficient superintendent goes to a new town where the quality of teaching is low and teachers are uninterested in their work, one of the first things he does is to plan for a series of teachers' conferences and study clubs. He tries to get the teachers working on different school problems, and reporting to each other on the results. He tries to have them feel that they are making a real contribution to educational knowledge, and that any suggestions they make will receive careful consideration. In like manner, if the quality of janitorial service is to be improved, one of the best ways of securing that result is to awaken the professional interest of the janitors through some similar organization.

Before very long there will probably be summer-school courses and evening classes for school janitors in which they can learn about different types of heating apparatus, school hygiene, and the like, and can qualify for the higher-grade janitorial licenses. Iowa State College is already carrying on extension courses of this kind, with marked success. Within the system, lecture courses and discussion classes may profitably be held by the janitors, and in small communities the janitors from several near-by towns may be invited to gather in one spot for such discussion. The

subjects for consideration at such meetings might be, for example: "Dust and its Dangers"; "How Diseases are Transmitted"; "Protecting School Buildings from Fire"; "Different Types of Heating Apparatus for School Buildings"; "Different Methods of Cleaning"; "Types of Vacuum Cleaners"; "New Vacuum-Cleaning Tools"; "Recent Experiments in Humidity and Ventilation."

The janitor as a teacher. As the professional interest of the janitors increases it will usually be found that many of them at least are able to give very interesting information concerning their own work. Many janitors already have a strong influence over the boys on the playground, but their connection with the children should be something more than that of monitors. The heating and ventilating plant of a large modern school is a very interesting thing, and presents opportunities for making children familiar with a phase of industrial life which many of them will not otherwise see. Some time during his course every school child should visit the heating plant of his own building. These visits should be under the direction of the janitor, who should carefully explain the workings of the plant, answer the children's questions, and regard himself as their teacher during that period. In similar ways the janitor can be called upon to coöperate with the medical inspector, teacher, and nurse in bringing home to the children the simpler phases of applied hygiene.

In the upper grades of some of our elementary schools pupils are regularly appointed as health officers. This work is given credit, just as is the case with regular school work. It includes the hourly reading of thermometers, weekly rounds for temperature records, adjustment of heat sources, opening of windows, etc. In the high schools and the upper grades of the grammar school, cultures may be taken from sweepings, floor surfaces, and so forth, and examined under

the microscope. Smaller children may be taught to wipe surfaces with white cloths in order to detect dust. Children in all the grades may be assigned to keep the yard in order, report on the cleanliness of toilets and basement playrooms, and the like. In the public high schools the teachers of science may contribute very largely to the increased interest of teachers, pupils, and janitors in questions of school hygiene by carrying on experiments with germ cultures, ventilation, moisture apparatus, and the like. Whatever work is done, it will usually be found of value to enlist the services of the janitor. His respect for his own position will be greatly increased, and his coöperation will usually have a wholesome effect on teachers as well as on children.

QUESTIONS FOR STUDY AND DISCUSSION

1. Make a study of janitors' work in your community, to determine how jobs compare in difficulty, where and how many assistants are needed, what changes should be made in organization, salaries, buildings, and equipment, in order to insure greater efficiency in janitorial service.
2. Which is better, for the school directly to employ all janitors and assistants, or to pay head janitors lump sums and let them hire and supervise their helpers?
3. What sorts of records should the janitor keep?
4. What is the story of "Typhoid Mary"? What should be done about such cases?
5. Of how much value are sulphur candles and similar methods for disinfection? How should a classroom be rendered safe after a contagious disease case has been found there?
6. If there is too much work for one janitor to do, and he has no helpers, which tasks may he best neglect, and to which must he give most attention?
7. Report on findings of different experiments in dust analysis. What do they imply?
8. Where teachers are firmly opposed to all suggestions for oiling floors, what shall be done about it?
9. How may old wooden floors be renovated?
10. Make careful periodic tests to determine how frequently windows should be washed in your community. Measure differences in lighting resulting from dirty windows.
11. Outline a course of study for janitors in service. What should a jan-

itor know? How should he be taught? Study courses already being given, and suggest desirable changes.

12. Make a collection of daily cleaning schedules, and compare requirements. Criticize.

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CHAPTER XI

MEDICAL INSPECTION

Medical inspection and compulsory education. The medical inspection movement has come as a direct corollary of the principle of compulsory education. The successful continuance of any democracy must in the long run depend upon the education of its people. In order to insure an intelligent and thoughtful citizen-population the State demands that several years of the childhood of every child born within its borders shall be devoted to gaining a common education, and in order that this may be more successfully done, it takes the matter completely out of the hands of parents. Insteady of having each one individually charged with the education of his child, the State establishes a public system of schools and makes attendance at these schools compulsory.

But having assumed this great responsibility for the education of its children, the State is also forced to go one step farther. It must provide that no physical harm shall result to the children under its care through the enforcement of the compulsory education law. It is on this basis that the State is justified in passing regulations for fire protection, that children may not be subjected to the danger of being burned alive during school hours. In the same way it establishes minimum standards for sanitation, the location of school buildings free from dust, noise, odors, and the like. Moreover, not only must it see to it that children are not subjected to physical dangers during their school attendance, but as a mere matter of efficiency, if nothing else, it is to the advantage of the State to insure that children shall

be in the best possible physical shape during the years of school attendance in order that they may take full advantage of the educational opportunities offered to them.

The importance of this type of health work has been recognized in the United States since the early days of public education. But the matter has reached an acute stage only with the growth of our larger cities, wherein we now find sometimes as many as three, four, or five thousand children gathered during five hours a day under one school roof. Where under the law children are grouped in such vast hordes as this, the danger of contagious disease becomes very great. Only constant watchfulness on the part of school authorities can avoid constant and serious waves of epidemics throughout the school population.

Origin of medical inspection. As a matter of fact, it was the effort to control school epidemics which first led to the organized medical inspection movement as part of the educational procedure in our larger cities. Arrangements were made whereby groups of doctors periodically inspected public school children, in order to make sure that incipient cases of contagious disease should be detected before the critical stage arrived, and measures taken to prevent their being passed on to other children. It is from this first stage of the work, inspection for contagious disease, that the popular name medical inspection comes.

It was but a short time after the school doctor became a recognized factor in education that new and vitally important discoveries were made. As the doctor looked at tongues and measured temperatures, he also could hardly fail to notice that many of the children had crooked backs, that throats were choked by enlarged tonsils, that breathing was interfered with by adenoids. The work which began solely as inspection for contagious disease quickly widened to include inspection for physical defects; and the work of mere

inspection was followed by organized efforts to see to it that these defects were remedied. That is, not only did we seek to keep one child from being a menace to the health of others, but we sought to render every child free from physical defects in so far as possible in order that he might be able to carry on his work without the heavy handicap of ill-health. It was found that many of the children who were supposedly dull or feeble-minded were actually partially blind, or partially deaf, or suffering most of the time from headaches or backaches. Children are curiously non-introspective persons. They often fail to realize it when anything serious is the matter with them, and sometimes they regard a headache if it continues all the time as a normal part of living. It required the keen eye of the medical inspector and the school nurse to discover that many of these children were actually in pain for many of their waking hours.

The effort to remove these defects resulted in carefully organized plans of campaign whereby teachers and parents could be taught the dangers of physical defects and various methods of helping or preventing them, and also in the establishment of school clinics in which the defects might be remedied by the school authorities. Eye clinics, dental clinics, food clinics, clinics for orthopedic work, and even surgical clinics have all been established in our various public school systems. The medical inspection movement, which started in so narrow a field, as the direct result of the compulsory education law, is gradually widening to include the whole subject of the health of the school child.

Present scope of medical inspection. Medical inspection of to-day includes four fields of endeavor: prevention of epidemics, discovery and cure of physical defects, provision of healthful surroundings, and formation of correct habits of thought and action in regard to health. It is in these last two fields that new and most interesting developments are

Fig. 20. Medical Inspection

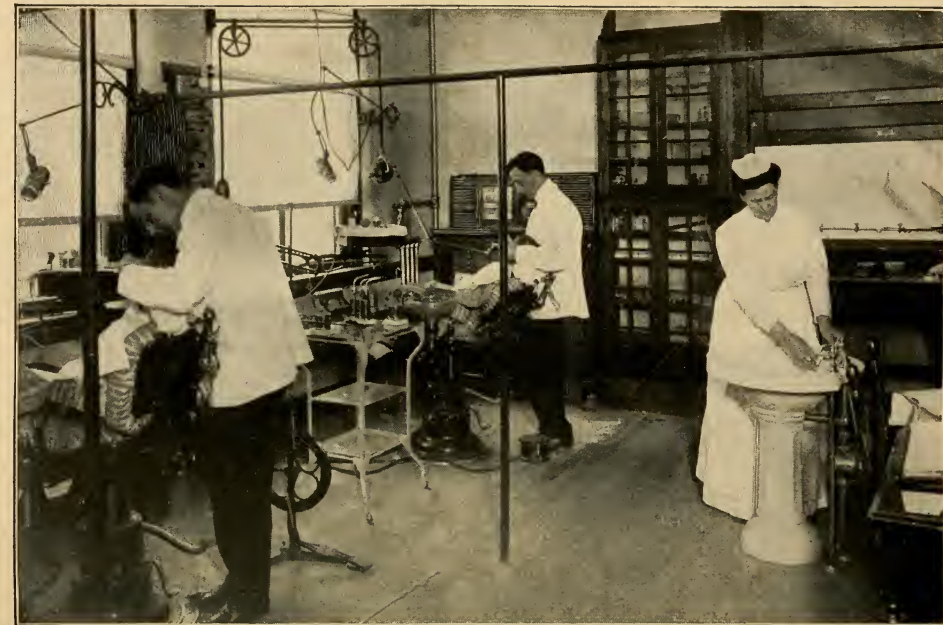

FIG. 21. A DENTAL CLINIC IN ROCHESTER, NEW YORK

(From Gulick and Ayres's *Medical Inspection of Schools*. By permission of the Russell Sage Foundation)

gradually taking place. The following quotation, taken from the volume on *Health Work in the Public Schools*, one of the Cleveland Education Survey monographs, relates to the fourth type of activity: —

> As a result of the work of doctors and nurses, Cleveland's children — and her teachers as well — should not only believe in plenty of sleep, but should go to bed early; not only disapprove of too much tea and coffee, but have strength to refuse when it is offered. Through classes for the anæmic and pre-tubercular the public schools help each year between two and three hundred children. This is worth doing, but they will render a far greater service to Cleveland, if, in addition, they succeed in giving to eighty thousand children, so firmly that it will never be broken, the habit of sleeping winter and summer with wide-open windows.
>
> The dentist, the oculist, the physician, should come to be regarded, not as dispensers of cures, nor sympathetic listeners to hypochondriacs, but as leaders to whom intelligent people go in order to forestall trouble, — specialists in health rather than disease. Leading its future citizens to form right habits of thinking and acting in regard to health is one of the greatest educational services which the public school can render.

Arguments against medical inspection. As is the case with most educational innovations, the introduction of medical inspection into the public schools met with opposition. It was claimed that any system that provided inspection by physicians at public expense was not democratic. In the first place, it compelled all people to pay for the care which individual parents should give their children. In the second place, it submitted all children to inspection whether their parents wished them to be inspected or not. Each of these items was considered an infringement of personal liberties. The answer to these arguments is that medical inspection is distinctly a democratic movement. It is the natural outcome of compulsory education legislation. As was stated in earlier paragraphs, it is the duty of the State not only to see that children are provided with

opportunities for an education, but also that they are in the best physical condition possible in order that they may take full advantage of such opportunities. Public taxation to support public medical inspection is justifiable on exactly the same grounds that public taxation is justifiable in order to support public education.

Again the argument is given that such a movement trespasses upon private domain. Medical inspection is peculiarly a personal matter. It is something to which individual parents should attend. Compulsory inspection intrudes upon the privacy of the individual. The person who raises this objection has either an entirely erroneous conception of the work of the medical inspector, or is suffering from a peculiar ingrowing sense of modesty. Field doctors and nurses are mature and well-bred persons; and where women doctors are assigned to work with high-school girls there is little danger of sensibilities being offended. The practice which is sometimes followed of assigning medical inspection work to young students in medical colleges is open, perhaps, to unfavorable criticism, but troubles arising from this source are very rare. Perhaps it is a good plan, whenever it is necessary, to have the child remove part or all of the clothing, to have one of the parents present. Most physical examinations can be carried on merely by inspecting the child as he stands, without asking him to remove any clothing. Under such conditions, there can be little ground for resentment or feeling that personal rights have been infringed, when the school doctor calls to the attention of parents defects in their own child.

Perhaps the most common objection to medical inspection in the public schools is that it tends to do away with private initiative. This argument is always raised whenever any public agency assumes the responsibility which has formerly been carried by individuals and private citizens. In the

case of medical inspection as it is now carried on in most of our cities there is little ground for such an objection, because the doctors and nurses do no more than call to the attention of the parents defects which need remedying. They rarely appeal to legal authorities, or in any other way endeavor to make correction of these defects obligatory upon the parents. They rather use all their influence in order to persuade or educate parents to the importance of remedying defects in their children while there is yet opportunity. Medical inspection is essentially an educational procedure. Doctor and nurse usually endeavor to place upon the parents' shoulders full responsibility for taking care of the health of their children. They stimulate private initiative rather than retard it.

In most communities there also will be some opposition to the medical inspection movement on religious grounds. There are many people who honestly believe that disease is spiritual rather than physical, and they object to any medical work because they feel that it encourages wrong methods of thinking. In answer to these people it can only be said that the weight of experience and all medical science is heavily against them. Until such objectors can prove a better case than they have so far been able to do, they have no valid ground for objecting to an educational procedure which assumes that disease and ill-health are real and should be combated. Except in the case of contagious disease, which in most cities is already covered by law, parents are not usually forced to follow the suggestions of the school nurse or doctor. There are many people who feel that the child should be saved from its parents in such a case, but as yet there is little legislation to that effect. Some school doctors have stated that it is better to let one child suffer through the neglect of its parents than it would be to appeal to force, and thereby run the risk of losing the friendly atti-

tude and sympathy of the other parents of the community. For non-contagious diseases force is probably justifiable only when arguments and persuasion fail.

Administration of a department of school hygiene. The various phases of health activity have grown up separately, and at different times. It is only very recently that we have begun to realize that the problems of medical supervision, physical education, playground work, school feeding, health classes for children, teachers, janitors, and parents, and the physical and mental examination of children admitted to the special classes are all properly related activities of the one general department of child hygiene, and should therefore be under the immediate direction of one responsible head. The director of hygiene should have the same rank as associate superintendent. He should be a doctor of medicine, and in addition should have had special training and experience with educational problems. The school physicians and nurses, supervisors of physical training, playground directors, supervisors of school lunches, and the school psychologist and his assistants should all be under the general direction of the chief of the department of hygiene.

It will be noted that all of these activities are being assigned to the regular school department. When medical inspection was first inaugurated in many cities, it was under the direction of the local board of health. As the work grew, it became evident that the field properly included something more than mere inspection for contagious diseases. The work of doctors and nurses resembles the work of teachers rather than that of policemen, and it became speedily evident that medical inspection was primarily an educational matter, and could properly be handled only by the educational authorities under the supervision of the school superintendent. There are still some communities in the country where the local board of health has charge of the medical

inspection of the school children, but in general the tendency is strongly in the other direction. The local board of health may properly undertake inspection for contagious diseases, but in the other lines of work which occupy by far the greater part of the time of school doctors and nurses the board of health cannot be expected to render efficient service. Medical inspection of schools is an educational matter.

Physicians. Directly subordinate to the director of school hygiene there should be in large cities a chief medical inspector. In small cities the regular staff of school physicians may be immediately under the director. School physicians should be mature men or women, thoroughly trained in medical schools, and possessing in addition considerable knowledge of public school matters. In the course of time provision will undoubtedly be made in the leading medical colleges for training in public school work. At present it is necessary to secure doctors from various sources who have had experience of this kind after leaving school. Great care should be taken in the selection of these physicians, and two common dangers should be avoided. In the first place, they should not be new, young students, fresh from medical school. People of this type are not apt to be received with favor by parents of school children. The medical inspector holds a difficult position, and should have considerable poise and experience. On the other hand, he should not be an elderly man who has gradually become unfit for practical service elsewhere, and so is shunted off on the public schools.

The chief medical inspector should watch his assistants rather carefully, in order to note how well they get along with teachers and children. A doctor may be well equipped in professional knowledge and still fail as a school doctor because he is unable to handle people. One of the biggest contributions which medical inspection in schools can make is to train children in the habit of consulting physicians

whenever anything is wrong. The school physician must inspire confidence on the part of the children.

Nurses. In addition to the corps of physicians there should be a relatively large number of highly trained, skillful nurses. These nurses should, in general, be registered nurses, and should be paid on the regular wage basis of other registered nurses in the community. The proportion of nurses to doctors will vary in different communities. In general it may safely be said that the nurse is the more important person. She is able to give greater service for the same amount of time and money. If choice must, therefore, be made, nurses should be secured rather than extra doctors. The properly trained school nurse under supervision is entirely capable of making preliminary diagnosis of most forms of contagious disease, and of making the routine physical examination of throat, lungs, heart, etc. She is as capable as the physician in giving treatment for small cuts, bruises, etc., examining vaccination marks, and the like. Probably the most desirable plan is to have a corps of nurses sufficiently large to take over almost entirely the routine examination of children for physical defects and contagious diseases. They should also be charged with home visiting and most of the educational work of the school which has to do with toothbrush drills, and the like.

There should be at least one general school physician charged with the direct oversight of the work done by the nurses. In addition there should be special physicians for such matters as cannot properly be handled by the registered nurse. For example, there should be in every large system one or more oculists who give their entire time to examining the eyes of school children. In small cities arrangements should be made so that a school oculist is available on part time. There should also be a physician who makes a specialty of nose, throat, and ear cases, and others

who are especially skilled in diagnosis of diseases, particularly those having to do with the heart and lungs. In every city system there should be at least one full-time dentist. Dentistry, in fact, is one of the most important forms of medical work for public school children, and one most frequently neglected.

The chief of the hygiene department should give all his time to the work. In large systems, where there is a chief medical inspector, he also should be on full time. The amount of time given by the special physicians just noted will depend on the size of the system. In large cities it is probably desirable to have an especially skilled physician in these branches giving full time to school work. The nurses should always be on full time. They should be hired for twelve months in the year, but be given one month's vacation during the summer. Under the plan just outlined there should be a sufficient number of nurses so that no one will have more than two thousand children to take care of. It would be distinctly better were the number decreased to one thousand.

In the case of both physicians and nurses it is essential that the rate of remuneration be such that good service can be secured. It is usually a mistake to accept volunteer service, or that given at less than the regular rate. Such arrangements may be good for short periods, while the system is at first being tried out, but in the long run it will be found that the work suffers when run on a charity basis. If physicians are secured on full time they should be paid salaries large enough to warrant them in devoting their best thought and energy to school service. Under the plan here outlined only a few physicians will be necessary, but they should be of thoroughly high grade.

In the smaller systems, where fewer people can be employed, there should be one physician in general charge

of the work. Some arrangement should be made whereby the services of other specialists could be secured for special cases when needed. But where funds are scarce the chief reliance should be placed upon a fairly large and thoroughly efficient corps of nurses. The State also should be active in the matter, and a State department of child welfare should be organized, with State supervisors supervising and encouraging the different phases of child health and child welfare work throughout the State.

Inspection. Inspection may be made of whole classes at a time, or of individuals. It is probably wise to have general class inspections frequently throughout each term, and immediately after each vacation, to detect incipient disease. During these inspections the physician or nurse visits the classroom and walks rapidly up and down the aisles looking for signs of colds, fever, or other preliminary symptoms of contagious disease. If such routine inspection is made after every vacation, the danger of spreading epidemics is greatly lessened.

In addition to the classroom inspection, there should be a more careful examination of every child in the system at least once a year, in order to detect physical defects, such as deafness, poor eyesight, incipient tuberculosis, heart trouble, hypertrophied tonsils or adenoids, spinal curvature, and the like.

In addition to the classroom and individual examination, teachers should be taught to recognize the preliminary symptoms of many of the commoner diseases. They should be instructed how to apply the simpler tests of hearing and eyesight. Such instruction is of value partly in order to enable the teacher to assist the school nurse and physician in locating difficult cases, and largely in order to give her an understanding of the importance of medical inspection and the part that physical handicaps play in the problem of backward children.

Records. A cumulative record system should be installed by the medical inspection department in every school. When the child enters school he should be given a card. After every yearly individual examination, and such other examinations as are given him during the year, a record of the result should be entered upon this cumulative card. The card should follow the child wherever he goes, from grade to grade, from school to school, and from city to city. It should be kept on the teacher's desk, and should be sent by her to the medical inspector whenever the child is sent for an examination. In this way the teacher is given a complete record of the child's physical history and the information therein contained frequently makes her better able to deal with the particular problem the child presents. These medical inspection records should contain spaces not only for defects found, but for defects remedied, and the cards should be so arranged that failure to follow up or remedy defects will be clearly noted.

Clinics. Every school building should have a small room set apart for the use of doctors and nurses. This room should be equipped as noted in chapter III. Regular hours should be posted at each school, showing the time when the nurse will be there to give simple treatment for minor ailments, such as boils, ringworm, and the like. In certain of our more successful city systems these hours have been open to the parents of the children, and in many of the poorer districts fathers and mothers come in and bring their smaller children for advice, and even in some cases for simple treatment. In this way the work of the medical inspector reaches out to the entire family, and the cordial coöperation of the neighborhood is gained. Such a plan has real educative value.

In addition to these simple school dispensaries there should be one or more school clinics depending on the size of

the system and the public clinics at hand. Most systems, for example, will find it necessary to have one or more well-equipped dental clinics, where children's teeth may be put in order. In larger systems the eye clinic is becoming a very real necessity, and ear, nose, throat, surgical, and orthopedic clinics are sometimes found. In addition, in most large or fairly large cities, there will be found public clinics or dispensaries whose services may be utilized for school purposes. Local hospitals are usually glad to coöperate.

Follow-up work. It is of little value merely to discover defects. It is of immense value to see that such defects as are discovered are remedied. Perhaps the most important part of the work to be done by school physicians and nurses is in the follow-up campaign. Thereby an endeavor is made to persuade parents of the importance of attending to their children's physical handicaps. There are three general phases of follow-up work. In the first place, every time some important physical defect is discovered, a notice is sent to the parents of the children. This notice explains the existence of the defect, gives a brief statement as to its nature and its importance, and urges the parent to consult his own physician as to the wisest treatment. When carefully worded these notices are undoubtedly of considerable value. Care should be taken, on the one hand, not to make them too technical, so that parents will not understand them, and not to make them brusque or discourteous on the other.

In the second place, follow-up work may be successfully carried on by conferences at the school building or at the physician's office. Instead of sending the usual notice to the home, a note is sent telling the parent that a defect has been discovered and asking him to come to the school and talk it over with the school nurse or physician. Regular office hours are held each week at the schoolhouse for this purpose, and parents are encouraged to come in and talk

over the problems of their children, even when notices have not been sent. The plan of holding parent conferences is usually more effective than that of merely sending home notices. The notice is apt to be disregarded, but a request to call at the school is more important, and after the call is once made the skillful physician or nurse is usually able to impress the parent with the importance of putting his child in good physical condition.

The third, and perhaps the most effective, form of follow-up work is that whereby the nurse goes to the home of the child, and personally visits the parents. In this case she is able to see something of the child's home surroundings, and frequently finds information which is of real value in judging the case. She also forms a connecting link between the home and the school. If need be she makes many visits covering long periods of time, in order to watch over the child's progress and to keep in touch with what the parents are doing. The nurse's program should be so arranged that she will have several hours each day for this most important part of her work.

Staff attitude. If the medical work of the school is to be efficiently carried on, it is important that there be good staff coöperation. This may be secured, in the first place, by frequent conferences of physicians and nurses meeting together and talking over their problems. It is important in this connection that the traditional attitude of the nurse toward the doctors give way somewhat, so that she may feel free to talk with them and offer suggestions from her own experience. The stricter etiquette of the hospitals should be relaxed, and the nurse made to feel that she has something real to contribute through her experience to the other members of the staff. Staff conferences of nurses and physicians should be held at the beginning of the year, and at frequent intervals thereafter. Clinics should be held whereat chil-

dren are examined, and the methods of examination, the terms used, methods of recording information on cards, etc., should be talked over by the staff and a uniform procedure agreed upon, so that the records of each physician and each nurse shall mean the same to all the others. This is a most important consideration if the statistics of the department are to be used for further study.

During the year various members of the staff should be encouraged to bring in problems which they meet in the field, and ask suggestions from the other members as to the best means of handling them. Occasional conferences should be held with the principals and teachers of schools. In planning these staff programs it will be found that the best results are secured if a certain subject or several subjects are selected for special consideration during each year. For example, one year devote attention to locating the children showing defects of vision, and have many of the yearly conferences centered about that subject. Another year, perhaps, spend considerable time in studying the question of malnutrition; another, such difficulties as hearing, stuttering, or the like. This does not mean that the existence of other defects should be ignored, but rather provides for a system of rotating or varied emphasis, so that doctors or nurses will not run the danger of getting into a rut and losing interest in their tasks. In any group of workers interest in a subject is apt to rise on a wave, and then sink as the novelty wears off. The wise chief of staff will so plan his work that every time the wave of interest begins to descend, another subject will carry it upward again, and the members of the staff will be kept alive and keen all the time.

A successful means of keeping the staff's interest is by making a regular self-survey of the work. By this means the reports from different districts are handed in to the medical supervisor, and comparative charts are arranged

showing the results gained in different subjects by districts. On these charts the names of the medical inspectors and nurses are usually omitted, so that no one looking at them can tell who is responsible for a given record. A figure or letter is substituted for the name of the person, and all other distinguishing marks are removed. For example, the number of children showing eye defects and the number of defects remedied for each district is compiled and shown. A meeting is then called and the results are exhibited. Naturally the members of the staff are all eager to see which district shows the greatest proportion of eye defects found, and of those found, the greatest proportion remedied. Each knows his own score, but not that of the others, and is able to make a comparison of his work with that of the rest of the staff, yet without being obliged to state his conclusions aloud. Different schemes of this kind will keep the staff eager to learn from each other, and on the alert for new methods of procedure.

School physicians and nurses should all be encouraged to visit the medical inspection departments in other cities. It is now an accepted principle that school teachers should go to visit the work of other teachers in their own neighborhood and elsewhere, and it should be equally accepted that the school physicians and nurses can learn much by seeing how the same work is done in other places, and comparing the results there obtained with those obtained under their own system. Members of the medical inspection staff should also be given opportunity to meet other members of the school system. They should be invited to speak at teachers' conferences, and at the larger educational conferences of county and State. They should be asked to present papers at teachers' institutes, and should be encouraged to write papers for publication. In every way the professional importance of the medical inspection division

should be magnified and the members of the staff made to feel that they are rendering an important educational service to the community.

Textbooks on school hygiene. The early books on school hygiene devoted a large part of their space to questions of medical inspection. They usually gave one chapter concerned with the organization of the medical inspection staff and its relation to the board of health. In addition, several chapters were usually devoted to the detection of contagious diseases, the symptoms of the commoner forms of eye diseases, skin troubles, and the like, tests for vision, tests for hearing, inspection and treatment of cases of spinal curvature, psychological examinations for backward children, and similar problems. The problem of school hygiene, in fact, was considered as being very nearly the same as the problem of medical inspection, and subjects which properly pertained to one also pertained to the other.

At the present time, however, we have come to regard the subject of school hygiene as considerably larger and more inclusive than that of medical inspection. Medical inspection is simply a branch, although an important branch, of the general subject of school hygiene. The textbook on school hygiene should outline the general formation and work of the department of medical inspection, but if it be a textbook of ordinary size it cannot properly deal with the more detailed problems of medical inspection, because these problems are too important to be considered in the superficial manner which would be necessary were they to be confined within the limits of a single volume which also has to deal just as fully with the other problems of school hygiene. Most students of education do not need to know the details of examination for infectious or contagious diseases, the methods of testing sight, and hearing, and the like, or the best methods of treating the defects

found. Such a student should know in general the make-up of medical inspection corps, the reason why it should exist, the arguments which will be brought against it, and the service which it may properly hope to render. He should leave to the members of the staff the more technical information which it is their business to learn.

QUESTIONS FOR STUDY AND DISCUSSION

1. Where did school medical inspection start? Under what circumstances? Trace the spread and development of the system.
2. Compare the arguments presented by those favoring medical inspection by boards of health, and those favoring medical inspection by school authorities. What is your own conclusion?
3. A school principal recently said: "After all, medical inspection is intended merely for poor children. Rich children don't need it." Do you agree? Why?
4. Suppose you were superintendent of a city of two hundred thousand or over, and a tenth of the population was opposed to medical inspection on religious grounds. Would you enforce it? What about vaccinations? How far are legal measures for enforcement of health regulations justifiable?
5. If it is proposed to establish a department of hygiene in your school system, the supervisors of physical training, supervisor of school lunches, psychologist, and other persons who would become subordinate to the head of the department would probably strongly oppose the idea. How far is the plan worth fighting for?
6. Most physicians are unalterably opposed to the proposition that nurses should be allowed to exclude children from school on suspicion of contagious disease. What are your views? In most systems the doctor only calls at the school once or twice a week. Should the nurse be allowed to make diagnoses say on Monday, Wednesday, and Friday, but not on Tuesday or Thursday? What should she do?
7. One physician said, "We don't pay any attention to adenoids because most parents won't do anything about them." What attitude should the school take in such a case?
8. Where there is no system of medical inspection what can teachers do? What suggestions have already been made to rural-school teachers?
9. How can a school surveyor most quickly secure a fair basis for judging the effectiveness of the medical inspection system?

SELECTED REFERENCES

Most of the school survey reports have sections on this subject. See especially the reports on Denver, Portland, Springfield, Illinois, Buffalo, Butte, San Antonio, Salt Lake, Leavenworth, Cleveland, and Brookline. The following books will all be found valuable for further study:—

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CHAPTER XII

PHYSICAL TRAINING AND RECREATION

Recreation surveys. On two afternoons in November, 1914, during the hour and a half which elapsed between the close of school and supper-time, four investigators walked through the streets of the little town of Ipswich, Massachusetts, looking carefully about the streets, the vacant lots, yards, parks, and playgrounds, and making note of every child they saw. They noted what each child was doing and where he was doing it. They also made a quick judgment as to the probable ages of the children. During the three hours of their studies these investigators saw about seven hundred children, — four hundred and fifty of them boys, and two hundred and fifty of them girls. Exactly two thirds of all the children were either standing still and doing nothing, or else were walking slowly up the street apparently idling their time away. Moreover, although Ipswich is a town of homes with ample yards and a wealth of open fields and play space, it was found that most of the Ipswich children played or walked around in the public street. This was especially true of the girls. More than three fourths of them were in the streets instead of in yards or playgrounds.

Nor is this condition found only in the small town. A few months earlier than the Ipswich investigation a similar census was taken in Cleveland, Ohio, under the direction of the chief medical inspector and assistant superintendent in charge of physical education. Here are the conclusions drawn from the Cleveland census: —

1. That just at the age when play and activity are the fundamental requirements for proper growth and devel-

opment, forty-one per cent of the children were doing nothing.

2. Fifty-one per cent of all the children seen were in the street in the midst of all the traffic, dirt, and heat, and in an environment productive of just the wrong kind of play.

3. Only six per cent of the children seen were on vacant lots, despite the fact that in most of the districts vacant lots are available as play spaces.

4. Even though thirty-six playgrounds were open and sixteen of them were supplied with apparatus, only eleven per cent of the children seen within four blocks of a playground were playing on it.

5. Of the 7358 children reported to have been seen playing, 3171 were reported to have been playing by doing some of the following things: fighting, teasing, pitching pennies, shooting craps, stealing apples, "roughing a peddler," chasing chickens, tying cans to dogs, etc.; but most of them were reported to have been "just fooling," not playing anything in particular.

The report concludes, "We need more and better playgrounds, and a better-trained leadership."

Commercial amusements. In both these investigations reports were made solely on those children who were actually outdoors. There were undoubtedly large numbers of children who had sought amusement elsewhere. It is an illuminating experience for one who is studying the use of leisure time by school children to go into the neighboring "movies" about half-past four o'clock in the afternoon. It is not uncommon to find a large moving-picture hall entirely filled with young children, with hardly more than four or five adults in the entire audience. In some regions practically every child in school is a regular attendant at the movies. Some of these children go two and three times a week, and for many the movie has become the chief means

of recreation. The movie is most frequently patronized because the admission charge is so low; but it has been found where studies have been made that young children in the elementary schools are often frequent visitors at vaudeville shows and the cheaper theaters. About a fifth of all school children, in the larger cities, at least, go to the regular theater at least once a month, and sometimes more frequently.

When we speak of commercial amusements we usually think of those amusements which are on a money-making basis and intended to attract adult persons. As a matter of fact, many of the most successful commercial enterprises cater largely to children in the grammar and high-school grades. Many forms of recreation which are attractive and desirable in themselves when placed on a commercial basis become surrounded by undesirable influences. Take, for example, the case of the game of billiards. In the survey made by the Department of Recreation of the Russell Sage Foundation, entitled *Recreation in Springfield, Illinois*, we find the following quotation:

> Billiards is an extraordinarily attractive game. Scientific, unusually free from the factor of chance, it offers the player unlimited opportunities for the improvement of his ability to judge spaces, coördinate the muscles, and exercise persistence of endeavor. The green felt, the shining balls, and the straight hand-liking cue all please the senses. Being played indoors, by day or by artificial light, the recreation afforded by billiards and pool is at all times independent of the weather, and it is an especial boon to the worker during the long winter evenings when outside sports are not so regularly available. Furthermore, these are eminently sociable games drawing together persons of similar ages and tastes, and allowing all the delights of jest and witticism to animate the spirits while the play is going on.
>
> But in Springfield, just as is the case in most other cities, the opportunity to play billiards is almost everywhere linked with powerful temptations to use alcoholic beverages. Of the sixty

holders of billiard and pool licenses, thirty-six also hold licenses enabling them to have saloons on the same premises. The young men who frequent these pool-rooms cannot escape the odors from the bar-room, the contagion of custom, or the compulsion of a hospitality that is none the less powerful because it takes the form of alcoholic refreshment.

The temptation to intemperance is not the only evil in the surroundings of the average commercially managed billiard-room. Often gambling operations hover in the proximity, and sometimes the brothel is not far away. Moral hazards such as these menace, each year in Springfield, thousands of young men who are pursuing the pleasures of a game which is in itself as beneficial as it is enjoyable.

There are also public dance-halls in Springfield where pass-out checks are given to the patrons which enable them to visit neighboring saloons during the progress of the evening's program as often as they desire. The young women in attendance may not only dance with partners who have been imbibing, but, since introductions are not customarily required, they may at any time receive invitations from persons regarding whose irresponsible character and vicious habits they may be absolutely ignorant. To thousands of Springfield's young people dancing is a perfectly normal mode of social life, and the only feasible opportunity they have for enjoying it is now surrounded by moral pitfalls of the most dangerous and insidious character.

Space for play. If children are to have healthful and normal play activities two things are necessary: first, opportunity; and second, leadership. In the smaller towns every home is usually fitted with a yard, and there are many vacant lots and open fields in which children may play. In the larger cities there are only occasional parks and playgrounds and children, at least in the poorer districts, are usually restricted to playing in the streets or on the roofs of buildings. In New York City, for example, groups of boys are observed much of the time on the tops of tenement roofs flying kites or scaring pigeons. In some of the most thickly populated cities it has even become necessary for the authorities to close certain cross-streets after school hours

and give them to the exclusive possession of children, so that the little folks may have some place where they can play without the danger of being run over by passing vehicles.

As has already been pointed out, however, street play is not confined to the children of the larger cities.

> Springfield does not, with its ample school grounds, park spaces, and home grounds, face the necessity of such intensive use of streets. But the fact remains that the streets are much used for play, and, with school grounds closed after school hours and school buildings practically unused for recreational and social purposes, the youth of the city are forced to resort to the streets and the commercial amusement places for their afternoon and evening recreations. A visitor to the city cannot but be impressed by the unusually large numbers of young people from twelve to twenty-two years of age drifting up and down the "downtown" streets in the evening.

The people who were making the recreation survey in Springfield expressed great surprise when they discovered that the spacious school yards for which Springfield is noted were used only during the recess period, and that after school hours and on Saturdays and during the long summer vacation the grounds for the most part lay idle, while children played in the streets or trespassed upon private property. It is unfortunate that surprise at such condition cannot be more generally felt by persons acquainted with other public school systems. It is probably true that most schools close their yards to children after the school day is over. In Cleveland, for example, the rules of the Board of Education read: "Pupils will not be allowed to . . . remain on or revisit the premises after dismissal of the school, except by special permission of principal of the building."

Not only are children frequently refused admittance to the playground, but the yards themselves are surrounded by high iron fences with locked gates. It is noticeable, too,

that not infrequently the fences and gates around playgrounds are most impregnable in regions where buildings are most crowded and children are most seriously in need of playground space. The principal of a grammar school in one of the poorer sections of a wealthy Massachusetts town, speaking of the playgrounds, said: "We used to have a good supply of playground apparatus, but the children swarmed to the yards in such numbers and became so unruly that we simply had to take down all the swings and bars. There are a lot of tough gangs in this region, and we can't allow them to damage our school premises." In a somewhat better portion of the same town the school principal says: "Of course the children don't use the playground. We don't expect them to. Home is the proper place for school children, and they ought to be made to stay there."

It is perhaps only human for principals to wish to avoid the responsibility entailed in governing groups of children at the school playground, and this is particularly natural in regions where children are rough and unacquainted with the ethics of fair play. It is, however, true that one of the most important elements in the education of the child is to be found through wisely directed recreation and group activity. Most thinking people agree that lessons in moral education cannot successfully be taught solely by the lecture method. Sunday-School lessons or daily morning talks by teachers must remain relatively ineffective, unless the child is given an opportunity to try out those lessons for himself and put the meaning into practice in his own daily living. Supervised recreation is a laboratory for ethical experiments. It is one of the most useful means which the school can employ in teaching children the codes of citizenship.

Part of hygiene teaching. There are many cities which have already recognized the educational value of supervised play. The field of physical training is gradually widening

until it includes not only the old-time calisthenics, but also various types of athletic sports, games, and other forms of recreational activity. The division of physical training and recreation should be one branch of the department of hygiene, and the supervisor as the head should be directly subordinate to the director of the department of hygiene. The membership of the staff must depend largely upon the size of the city, but should include general supervisors having under their charge the work of teachers in classrooms and on the playgrounds, a corp of specially trained playground teachers, and a corp of special instructors who can give work with gymnasium apparatus, lead the sports of basket-ball, baseball, and the like, and act as coaches and instructors for the various athletic contests.

Coöperation of medical inspectors. It is essential that the division of physical training and recreation shall work in the closest possible coöperation with the division of medical inspection. Medical inspectors in making their routine physical examination should keep in mind the requirements of the physical-training department, and in the cases of elementary schools as well as high schools should indicate for each child whether he should take the full athletic work, or whether certain types of work should be entirely omitted or given in small quantities. When gymnasium classes were first established in elementary and high schools, it was a common experience to have many of the children bring notes from their family physicians, stating that they were unable to do the regular physical-training work. It has been successfully demonstrated that if careful medical inspection is carried on at the school, and the program of the child modified in accordance with the suggestions of the doctor, objections from home rapidly diminish in number. Children who would otherwise have been deprived of all physical training now receive a small portion which they are well able to

carry, and in many cases improve so rapidly under the modified program that within a year or two they are able to carry much heavier work with benefit to themselves.

Posture work. The experiment has also been tried of having a specialist in the correction of postural defects engaged as a regular member of the physical-training staff. Children even in the lowest primary grades are frequently found suffering from round shoulders, crooked backs, fallen arches, and other defects which can either be completely remedied or very greatly helped if corrective exercises are given in time. It is, of course, essential that any instruction along this line be under the direction of a specialist in corrective orthopedic work. Where the divisions of medical inspection and physical training work together in this activity, they may render a service of supreme importance. When the examinations are being made by the medical inspectors, such postural defects are noted, and word sent to the posture specialist of the physical-training department. Certain of the cases found will be too difficult for the school authorities to handle successfully with their small staff, and should be referred to orthopedic physicians or hospitals. Other cases, however, can be greatly helped by simple school procedure.

One plan sometimes followed is to form small classes in each school, consisting of from three to ten children, and to set aside periods of ten or fifteen minutes, probably not longer, each day, in which will be given setting-up exercises and simple forms of apparatus work. The apparatus needed for these cases is so simple that the janitor can easily put it up in any classroom or hall, under the direction of the physical-training supervisor. These setting-up drills are not so much for the purpose of developing muscle as for making the children familiar with what is desired in the way of posture. A child cannot "stand up straight" or "throw his shoulders

Fig. 22. Physical Training — Girls

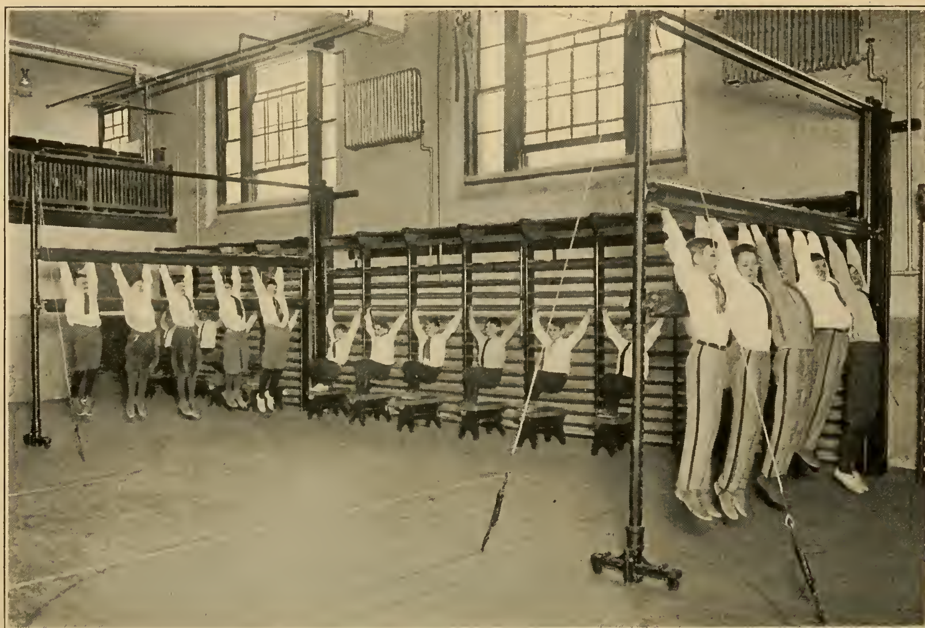

Fig. 23. Physical Training —Boys

back" unless he knows, through his own repeated experience, what the muscle feeling is when the correct attitude is assumed. Repeated instruction or scolding will be of very little help. What must be done is to take the child and actually place him in the desired position, showing him in the mirror the difference it makes in his appearance, and having him practice throwing himself into a good posture under the supervisor's direction. When a child with stooping shoulders once learns what is actually required of him, through having himself experienced the way it feels to have his muscles properly in place, half the battle of correcting the defects is won.

The work of the physical training and medical inspection divisions must not stop there, however. Besides giving the setting-up drills each day to squads of children with defects, teachers must be given the habit of watching the posture of all the children in their classes, and of encouraging children so that all of them will feel the desirability of sitting and standing in the correct position. Then, too, care must be taken to get in touch with parents of children and to see to it that they understand not only the nature of the trouble, but also what the school suggests to the child and what it is trying to do through the setting-up drills. When a mother hears the instructions given to her small boy, she almost invariably becomes intensely interested, and helps him at home by reminding him of the exercises he should take, and encouraging him when he does well. In many cases the school, by a few interviews with parents, is able to change their attitude of ignorant indifference or carping criticism. Many parents, through very anxiety for their children's welfare, become so obnoxious with their constant scolding that the children themselves become stubborn, and feel that there is no use even in trying since all their trying seems to meet with no reward. If the school succeeds in showing such

parents how to help their children, instead of discouraging them by non-understanding criticism, it will contribute an enormous factor toward the child's success.

Physiological age. The work of the division of physical training and recreation should be confined neither to the high school nor to the elementary school. In many systems one or the other is almost or entirely neglected. In the well-organized system the division will include both branches, and will even arrange for contests between the older children of the elementary schools and the younger children of the high schools. The division between the two groups is entirely an artificial matter, and should not be allowed to assume the importance that it generally does assume in the minds of children and community. There is a popular misconception to the effect that all the children in each grade are of practically the same age and at the same stage of physical and mental development. As a matter of fact, we know that there are children in the eighth grade of the grammar school who are less proficient in many of the school studies than are some children in the first and second grades of the same school, and in like manner there are some children in the first and second grades who are more able in certain school studies than children in the higher grades. Similarly, it is true that one will find, stretching all the way from the fifth grade through the junior high school, boys and girls who have practically the same physical development. The adolescent period is not peculiar to the high school, nor is the pubescent period peculiar to the elementary school. Each group is represented by children who are students in the other type of school. In organizing physical training and recreational activities, then, we must take this matter of a distribution of physiological age into account, and see to it that opportunities are provided which fit not merely the children of a particular grade, but rather the

children of a particular stage of development no matter in what grade or in what school they may be found.

Classroom exercises. Until very recently it has been the custom to confine physical training to certain calisthenic exercises, given several times a day by the classroom teacher, between recitation periods. Recently, however, a strong tendency has developed either to eliminate calisthenics entirely, or to place them in a minor rôle, and to give the time formerly occupied by such work to simple forms of classroom games. This point of view is illustrated from the following quotation, taken from the recreation survey of Ipswich, Massachusetts: —

> Calisthenics are necessary in the schoolroom to shake off drowsiness, renew energy, and provide an outlet for the natural restlessness of boys and girls. But calisthenics are at best perfunctory activities, without the free, adventurous, imaginative qualities of games and free play. Few take calisthenic exercises in after life. They do not build lifelong habits. They lack the coöperative team work, opportunity for developing real leadership, and stimulation found in free games and active play. No incentive to succeed, no training of good sportsmanship exists. Calisthenics are better than nothing, they are a step in advance, but they are not sufficient in themselves to insure physical efficiency and to teach the social lessons demanded of the school to-day.

In Cleveland, calisthenics are omitted entirely from the primary grades. Periods of "rest and recreation" occur several times a day, at the discretion of the grade teacher; and during these periods many formal games are carried on. Where such indoor games are popular and well taught, there is sometimes noted a tendency to do away altogether with outdoor recess. The Cleveland Report holds that this is a distinct mistake: —

> Valuable and desirable as the indoor play periods may be, they are not a complete substitute for outdoor play during the school session. When the recreational activities of children are transferred from outdoors to indoors their value is lessened through: —

1. Loss of fresh air.
2. Lack of sunshine.
3. Restriction of space and full freedom of activity.
4. Diminished pleasure.
5. Narrowed range of activities.
6. Extreme brevity of the period.
7. Dust raised by the running and jumping.

The spontaneous play of children is now generally recognized as the expression of such fundamental human instincts as hunting, fighting, creating, nurturing, imitating, etc. All out-of-doors is none too large to provide the needed stimuli to these instincts, and every unnecessary narrowing down of environment denaturizes by so much the essentials in child play.

Recess. The report gives strong warning, however, against the practice of sending children outdoors at recess and expecting them to play in a wholesome manner: —

Under conditions attending recesses that are unorganized and that lack method, children do nevertheless play games, but there is a vast deal of informal, sometimes anti-social, and relatively valueless romping and scuffling, and the recess becomes a period, not of genuine social increase, but rather of social leakage.

Moreover, it is essential that the games conducted at recess and on the playground should be distinctly athletic in character. In discussing the list of games issued by the department of physical training in Cleveland for use in grades from three to eight, the Cleveland Report says: —

While the playground games come nearer supplying the elements needed, even these fall short of what is desirable. They consist very largely of games of tag, and the simpler games played with an inflated ball. Not one of these, by any stretch of the imagination, could be conceived as holding such widespread interest as do our great national games, which boys of grammar-school age universally admire and attempt. The playground games hold about the same relation to the national games that tether-ball does to tennis.

Athletic games in a very few years greatly influenced one hundred thousand Filipinos in departing from the ghastly custom of head-

hunting. But song games, room games, and playground games of the kind mentioned could never have converted Filipinos from head-hunting, nor can they convert or restrain from hoodlumism, from "bumming," from "rushing the drunks," from street fighting, and from other undesirable gang activities the boys who begin to participate in these things long before the elementary-school age is passed and the high-school age is reached.

Teachers and games. It is probable that many teachers will strongly rebel if it is suddenly suggested to them that they should act as leaders for active games during the recess period. They feel, naturally enough, that having worked hard all the morning they should be given a few minutes of quiet breathing spell while the children are out of the school, before they are obliged again to take up their classroom work. Moreover, not a few teachers have a feeling that it would be difficult for them to maintain discipline in the classroom were they to lay aside their official dignity long enough to lead in active games on the playground. It is probably true that there are certain teachers who would lose their hold upon the children were they to engage in any form of social activity with them. But such a situation is a clear indication that the teacher is using very questionable methods in the regular classroom work in order to secure good discipline. Really good teachers do not have to be particularly sensitive about maintaining an appearance of age and dignity in front of their children. Usually they will find that when teacher and pupils play together for a few minutes each day, the work afterwards in the classroom is on a much more friendly and human basis than it was before. In the long run, democracy is a more effective special method than autocracy.

So far as concerns the other objection, that the teacher is too tired to take part in playground leadership, the only answer is, "Try it and see." We send children outdoors at

recess because we feel that they are thereby made fresher and more able to continue the classroom work for the rest of the day. If this holds true for children, it would seem logical to think that it holds true for at least the younger teachers also. For the first week, perhaps even for the first month, many teachers will strongly dislike the innovation, partly because they are unaccustomed to this form of activity and feel both nervous and self-conscious. Let the playground games become an old story, however, and this feeling of strangeness gradually wears away. Most teachers, unless they are too old and stiff, will find that they enjoy the outdoor recess period as well as do the children, and that the classroom work afterwards becomes easier and more endurable for both.

Activities outside school hours. Organized play in the classroom and on the playground at recess may very successfully be led by teachers trained under the supervision of the physical-training and recreation division. We must not, however, exact from regular classroom teachers further service in play activities after school hours, unless we pay them for the additional time and make such service voluntary. A teacher or playground director should be in charge of the school playground every afternoon after school hours, and on Saturday afternoons throughout the entire school year. During the summer more workers should be added and the playground should be kept open daily, morning and afternoon. During the school year the expense for playground supervision is between one dollar and a half and two dollars per school for each afternoon, and three dollars for Saturdays. The cost during the summer would necessarily be somewhat larger. If school playgrounds are properly surfaced and equipped with simple apparatus they usually form a better playground than those which are established separately, because they are always accessible to large

numbers of children and are already supplied with shelter, drinking-water, and toilet facilities.

Athletics. It is commonly believed that all boys like to run and jump and join in competitive trials of skill, and that they do not need the expensive services of a hired director in order to teach them how to do these things. In fact, the person who suggests supervision for physical training and recreation in the public schools is certain to be faced with the sincere and scornful opposition of people who think that they know what they are talking about when they say healthy children do not need to be taught how to play. There is very little use arguing against a proposition like that. The only effective answer is found by studying the children themselves. We have already noted the survey findings as to the way in which school children employ their leisure time. Equally significant are the various studies which have been made comparing children under the old régime with those under the new. For example, in the Ipswich study previously referred to, boys in the fifth, sixth, seventh, and eighth grades of the elementary schools in Ipswich, Massachusetts; and in the districts of Manhattan, New York City, were given the same tests of running, jumping, and chinning the bar. The Report says: —

> These records are not the high marks obtained during the course of several years, but the actual physical rating of the boys in the regular work during the past year. The majority of these boys live in the most congested section of Greater New York, where the health conditions and opportunities for exercise do not compare favorably with those enjoyed by the boys of Ipswich. The important thing is that these city boys have had definite physical training and properly guided play as a regular part of their school work.
>
> The city boys can outrun and outjump the Ipswich boys. . . . The records of the Manhattan boys is not due to exceptional skill or greater inherent ability. It is due to the careful physical training in the school. The training that is given to the Manhattan boys ought not to be denied to the Ipswich boys. These figures do

not indicate inherent weakness nor ill-health. They prove beyond question that insufficient attention has been paid to the physical training of the boys in Ipswich.

The athletic-badge test. The records of the Ipswich and Manhattan boys were made with what is known as the athletic-badge test. This is a test adopted by the Playground and Recreation Association of America as furnishing standards to which every boy should attain. There is a similar test for girls. For the boys these tests are running, jumping, and chinning. Careful study has been made of the records of thousands of boys, and standards ascertained which should be reached by the average normal boy. These tests are as follows: —

Class A — For younger boys, usually those found in fifth and sixth grades. Sixty-yard dash, $8\frac{3}{5}$ seconds. Standing broad jump, 5 feet, 9 inches. Chinning, 4 times.

Class B — For older boys, usually those found in seventh and eighth grades. Sixty-yard dash, 8 seconds. Standing broad jump, 6 feet, 6 inches. Chinning, 6 times.

Class C — Standard for boys of the general high-school age. 220-yard dash, 28 seconds. Running high jump, 4 feet, 4 inches Chinning, 9 times.

In describing the plan the Ipswich Report says: —

In these tests the standard does not represent perfection, but merely a passing mark. Not to attain a passing mark is failure. The standard in these events corresponds to the sixty or seventy per cent which is the passing mark in academic study. The tests determine not only normal strength, but also ability to use and control strength. This is the goal of all physical training. If a boy can neither use nor control his body to a reasonable degree a vital element of his equipment for future usefulness is lacking. These tests are being used in the public schools in hundreds of cities and towns throughout the United States. They have been accepted as fair tests wherever used. The inability of any large proportion of the boys of any community to meet these requirements shows: first lack of physical training either at home or at school, and second the real need for just such training.

The tests for girls are as follows: —

First test — All-up Indian club race, 30 seconds. Basket-ball throwing, 2 goals, 6 trials. Balancing, 24 feet, 2 trials.

Second test — All-up Indian club race, 28 seconds. Basket-ball throwing, 3 goals, 6 trials. Balancing beanbag on head, 24 feet, 2 trials. When Indian clubs are not available the potato race, as specified in the rules, may be substituted.

Further details, with rules for administering the two tests for boys and girls, may be secured by applying to the Playground and Recreation Association of America, 1 Madison Avenue, New York City.

Group Athletics. It is desirable to have not only each child striving to improve his own physical record, but also to cultivate a test of group ability. Where athletic records are made for individual prowess alone there sometimes comes the temptation to beat out the other fellow, and the desire for personal success assumes too great a place in the child's mind. Moreover, when schools are anxious to win honors, there comes a very human tendency to encourage the better athletes and to discourage the less successful. One of the most effective means of doing away with this form of specialization and selection is to have competition by groups of children, rather than by children acting as individuals. These groups may be of equal numbers of boys or girls of the same age, or they may be entire classes of one school competing against each other, or different groups of equal numbers from different schools. The entire membership of the group is obliged to take part. If less than eighty per cent of the group are present, no record is given for that group. One desirable result of group competition is that, through the force of public opinion, every child is made to do his very best. Laziness which jeopardizes the group standing is not tolerated.

In each event the score is found by dividing the sum of the individual records by the number of competitors. This

makes it possible where necessary to have small groups working against larger groups, since the actual number of children in each group makes very little difference. In working for trophies to be awarded to different classes within the same school, or to entire schools within the district, competitions should be held in several different tests. The most usual are the three already cited in jumping, chinning, and running. Other events successfully used are kicking the football, throwing the baseball, the shotput, and the relay potato race. For groups of girls the most common tests are basket-ball throw, all-up relays, shuttle relays, folk-dancing, and hoop race.

Public school athletic league. As part of this new system of using athletics as a means for education athletic leagues have been organized in public schools in many of the larger cities throughout the country. Baltimore, Buffalo, Jersey City, Newark, New Orleans, New York, Salem, Massachusetts, San Diego, San Francisco, Seattle, Springfield, Massachusetts, Tacoma, Troy, and Washington, D.C., all have public school athletic leagues for boys and issue printed reports on their subjects. Athletic leagues for girls are somewhat less common, but are nevertheless being rapidly added in these and other cities. One of the most successful athletic leagues for girls is that of New York City. The following quotations are taken from the handbook of the New York League: —

> The problems involved in girls' athletics were much more difficult than those in boys' athletics, the athletics of boys and men being established through a long history of evolution, while girls' athletics was a new subject, which of necessity had to be largely experimental.

The fundamental policies adopted by the Girls' Branch were and are: —

> Athletics for all the girls.
> Athletics within the school, and no inter-school competition.

Athletic events in which teams (not individual girls) compete.
Athletics chosen and practiced with regard to their suitability for girls, and not merely an imitation of boys' athletics.

The Girls' Branch of the Public Schools Athletic League encourages after-school athletics for girls by: —

1. Offering pins and trophies for certain events.
2. Conducting free instruction classes in those events for grade teachers who volunteer their services for the after-school athletics.
3. Assisting to organize athletic clubs.
4. Supplying instructors, coaches, and assistants where the board of education is unable to do so.
5. Trying to secure enlarged facilities for outdoor exercise for girls.

The Girls' Branch is doing everything in its power to further the use of folk-dancing as a form of play for the benefit and pleasure of the children themselves, and is opposed to its use for exhibition purposes. Park fêtes are arranged as great play days, with the children in great numbers from many schools, dotted in groups over great meadows of fifteen acres or more which are roped off and kept clear for the children only. In this way the individual children are lost to view in the great throng, and the exhibition element is eliminated, while at the same time the sight of acres of happy girls, all dancing at the same time, is a more stirring and beautiful one than can be easily described.

If we are ever really to have athletics for girls generally, we must settle at least the following points: —

1. What exercises are likely to be injurious internally to matured girls?
2. What exercises are mechanically suited to the build of the average girl?
3. What are suited to her muscular strength and endurance?
4. What will contribute to her health and vitality, and help to fit her for a normal woman's life?
5. What form of physical activity comes nearest to containing for her the primitive appeal that athletics in the accepted sense hold for boys?

Wide inquiry among those who have had extensive experience with physical training for girls shows that athletic activities for girls fall into the following groups: —

For mature girls

1. Condemned
   - Broad jump
   - High jump (in competition)
   - Pole-vaulting
2. Doubtful
   - High jump
   - Running more than 100 yards (in competition)
   - Weight-throwing
3. Safe
   - Archery
   - Ball-throwing
   - Basket-ball (women's rules)
   - Climbing
   - Coasting
   - Dancing
   - Field hockey
   - Golf
   - Horseback riding (cross- and side-saddle)
   - Indoor baseball
   - Low hurdles (not in competition)
   - Paddling
   - Rowing
   - Running (not in competition)
   - Skating
   - Skiing
   - Snowshoeing
   - Swimming
   - Tennis
   - Walking

For immature girls

1. Condemned
   - Pole-vaulting
   - Running more than 100 yards
   - Weight-throwing
2. Doubtful
   - Basket-ball
   - Field hockey
3. Safe
   - Archery
   - Ball-throwing
   - Broad and high jump (not in competition)
   - Climbing
   - Dancing
   - Horseback riding (cross-saddle)
   - Low hurdles
   - Paddling
   - Rowing
   - Running (not in intense competition)
   - Skating
   - Swimming
   - Tennis
   - Walking

For mature girls	*For immature girls*
4. Especially beneficial and suitable	4. Especially beneficial and suitable
Dancing	Climbing
Paddling	Dancing
Rowing	Jumping (in moderation)
Running	Running (in moderation)
Swimming	Skating
Walking	Swimming
	Walking
	5. Best loved, most commonly practiced and with greatest primitive appeal
	Dancing (greatest unanimity of opinion in this answer)

Educational sports. Physical-culture departments should be careful not to confine their activities and interests merely to the field of individual or group athletics. Many of the most valuable forms of group education which can be given under the supervision of the physical-training department are not athletic tests, but different forms of games and sports. For example, we find leaders in the physical-training and recreation movement urging the necessity for establishing regularly organized baseball teams for both boys and girls; and wrestling- and boxing-matches for boys, tennis, ice-skating, riding, swimming, camping, hunting, fishing, and school hikes for both girls and boys are all included as educational activities which are essential to the proper physical and mental development of school children. "A teacher," suggests Dr. G. E. Johnson, "might be as instrumental in getting a girl interested in tennis as in getting her interested in Scott." Moreover, these activities must not be delayed until high-school or college age. Most of them should be begun by the ages of ten or eleven; and the

grammar-school years should be full of vigorous sound outdoor life as a regularly required part of the school work.

Wider use of the school plant. As has already been pointed out there are two essentials for educative recreation among children. One is adequate leadership, the other is opportunity. Not only must the division of physical training and recreation provide a sufficient number of well-trained leaders, so that all children may take part in organized games and athletics, but the school department must also see to it that facilities are provided whereby these things may be carried on. This means that school yards must be provided with ample space for games, must be given good service, and equipped with suitable apparatus. It means that at least one large playfield must be supplied so that different schools can meet together in contests. It means that the coöperation of the park department must be secured, so that the open fields in various parks may be utilized by school children. But in addition to all these matters, if the system outlined is to be made effective, full utilization must be secured of the school plant itself. Space must be given for basket-ball games, wrestling, boxing, dancing, and swimming, as well as for the quieter occupations of playing pool and billiards, singing, playing musical instruments, conducting amateur theatricals, and making things at the work-bench

To many people the social-center movement implies only the use of the building during the evening by parents of school children; and people quite forget that one of its most important functions is providing for children of school age, and for those children who are somewhat older than the regular school age, and may indeed have left school in order to go to work, some place where they can carry on recreational activities under leadership. There is little value

in passing rules against allowing children to attend public dance-halls, billiard-rooms with bars attached, cheap theaters, movies, or the like. If teachers and parents are sincere in wishing to combat the evil influences of commercialized amusements they must adopt a constructive attitude. Instead of forbidding children to attend public dances, they must organize dances for young people which will be held under desirable conditions. Moreover, these dances must be made attractive to the young people. If the floor is smooth and well waxed and the music good, boys and girls will readily come. If teachers and parents are wise enough to provide amusements of higher quality than those which can be purchased elsewhere, they will find practically no difficulty in securing patrons among the school children.

In the same way well-equipped billiard- and pool-tables, well lighted and in convenient location, should be opposed to the billiard-room found in the back room of the modern saloon. If amateur theatricals are to rival attendance at the movies and the cheaper theaters, they must be equally exciting and full of "pep." The same rule applies throughout. Offer the children what they want and they will come. It is of little use to offer to the tough gang of the neighborhood the opportunity to sit quietly in the schoolhouse and play checkers and dominoes for an evening, but by establishing a series of boxing-contests under the direction of a skilled trainer, we make the same school building a clubhouse for the whole gang.

It is not within the province of this book to go in any great detail into the question of social centers, since most of their activities lie in the field of school sociology rather than hygiene. Full information concerning their organization and activity may be secured either from the Extension Division of the University of Wisconsin, or from the Department of Recreation of the Russell Sage Foundation. In gen-

eral it may be said that they add little to the cost of education, and add greatly to its effectiveness.

Survey suggestions. In the discussion of this chapter quotations have extensively been made from three reports of recreation surveys. Each of these survey reports ends with a brief list of recommendations for the town surveyed. The following quotations taken from the work of Mr. Hanmer and Mr. Perry in Springfield, Mr. Knight in Ipswich, and Dr. Johnson in Cleveland, represent the practical suggestions made by recreation experts to fit the needs of three "real-life situations." They are included in the present discussion because in a brief way they outline what the work of a school division of physical training and recreation is gradually becoming.

Springfield. Recommendations for treating the Springfield situation are given in great detail, with concrete suggestions concerning the wording of city ordinances and the like. A summary of these recommendations is as follows: —

1. Equip and use school yards and some park space for play.
2. Provide for a centrally located athletic field for the schools.
3. Place the administration of all playground and school athletic activities in charge of the director of physical training and play.
4. Teach games for playground and home-yard use at play periods on school yards and other public playgrounds.
5. Remodel and equip school buildings for social-center uses.
6. Provide for administration of social centers through additions to the staff of the superintendent of schools.
7. Encourage the coöperation of neighborhood organizations in the direction and support of the schoolhouse centers.
8. Organize school athletic leagues for both boys and girls, thus insuring proper supervision of such activities and adaptation of exercises to the needs of the different age and sex groups.
9. Have a standing city committee on holiday celebrations.
10. Organize a municipal athletic league for the young men of the city.
11. Provide for the extension of Boy Scouts and Camp-Fire Girls.

12. See that there is proper inspection and control of the commercial amusements of the city.
13. Have a representative city committee on recreation to be responsible for a progressive and balanced development of all parts of the city-wide recreation program.
14. Do not attempt to do it all the first year. Make a beginning and work steadily toward the ultimate plan.

Ipswich. As is the case with the Springfield Report, a large portion of the Ipswich Report relates to concrete and detailed suggestions for handling the recreation situation. The summary of these recommendations is as follows: —

1. Physical training for all boys and girls as a regular part of the school curriculum.
2. Teaching of games for home and playground use. The extensive use of group games in physical training, and the use of the athletic-badge test and group athletics.
3. The employment of a physical director and play supervisor, and a woman member of the faculty, with special training, to care for the physical work of the girls.
4. Equipment of each school and school yard with sufficient apparatus to enable teachers to make the best possible use of recess time. Grading of school property wherever necessary to render it most useful.
5. The use of the Manning High School as a social center, and that such use be definitely encouraged and stimulated.
6. That in the next school building erected, a gymnasium with lockers and shower baths be provided. That it be equipped with movable furniture so that it may be efficiently used.
7. That the athletic field be equipped with a running-track, tennis-courts, and the like, and that a small field house be erected.
8. That the ground in the rear of the Burley School be adequately developed as a children's playground.
9. The organization of a Public Athletic League.
10. A permanent Celebration Committee.
11. The extension of Boy Scouts, Camp-Fire Girls, and other similar organizations.
12. That the commercial amusements should at all times be safeguarded.

13. That the administration of the use of the athletic field and steep-bank playground be placed in the hands of the school department.
14. Do not attempt to do all this the first year. Make a definite beginning and then work steadily toward the ultimate plan.

We realize that it takes time, thought, and continued effort to develop a system of public recreation in any community. The first thing to be done in Ipswich is to engage a physical director who as he studies the needs can best advise as to further steps. The program as outlined above will no doubt be modified as the work progresses. It represents an ideal to work toward rather than a hard-and-fast line of procedure. No work of this kind can succeed without the coöperation of the community at large. Ipswich will never have adequate provision for public recreation until Ipswich really wants it.

Cleveland. The last few pages of the Cleveland Education Survey monograph, entitled *Education Through Recreation*, read as follows: —

1. Cleveland is extraordinarily well equipped in plants and in teaching force for the conduct and administration of recreation in the public schools. Many of these advantages, however, are neglected.

The recesses should not be omitted, and they should be organized. This does not imply formality at recess. It does imply study and organization, so that the recess may count for the most possible, physically and socially. More "steam" is blown off in a skillfully organized, than in an unorganized, recess, and the social value is certainly far greater.

Better still, groups might take their recesses in rotation: outdoors in pleasant weather, in the gymnasium or playroom in unpleasant weather. This would increase the value of the recess and might be made the means of relieving congestion. To some extent this has already been done.

2. Schoolroom and indoor recreation should, so far as possible, become outdoor recreation. The play periods should be longer. The plays and games should reflect the deep, instinctive interests of children of the ages concerned. They should perpetuate the play traditions of the nation. The plays and games employed should not be devised at the desk — manufactured out of whole cloth; they should be the growth of generations.

3. There should be a relatively larger element of free play in the kindergartens and lower grades. The waste places, between wings of buildings and elsewhere, small and at present for the most part useless, should be thoughtfully equipped for the little tots of the school. With a slight expenditure these desert places can be made to blossom as the rose educationally and socially, to the relief of congestion, to the aid of teachers, and to the immeasurable benefit of the children.

4. The apparatus should be taken from storage, and the school playgrounds made inviting to pupils out of school hours. This will necessitate additional supervision, which should be provided.

5. The swimming-pools that have been begun should be completed, and both swimming-pools and gymnasiums should be justified by the use made of them.

6. Far more attention should be paid in the elementary grades to hardy, organized games. There both numbers and needs (even the adolescent needs) predominate, as compared to the high school. In Cleveland, schools can do larger service with plays and games in the grades than in the high schools. It would be better to turn the whole corps of physical-training teachers into the elementary grades and neglect the high schools than to practice economy so unequally at the expense of the grades as at present. The whole system of play and recreation for the grades should be revised with reference to educational and social aspects.

7. The general question of the wider use of school plants for play and recreation is complicated by local conditions. But in general it may be said that the schools contribute relatively little to the social activities of the several neighborhoods. This subject is considered more exhaustively in the section of the Survey Report entitled, "Educational Extension."

8. Some reorganization of the educational corps should take place with a view to efficient administration of play and recreation from a broad educational and social standpoint. This would lead to a far greater influence of the school upon the out-of-school life of the community. Through lack of greater influence of the school during out-of-school hours, there is a great social leakage for which the city must pay.

9. The school is the natural and logical agency for the safeguarding of the great fundamental interests of children and youth. Each year discloses more and more clearly that the school is the one institution we have yet conceived that is best fitted adequately

to conserve these interests and utilize them for educational and social progress. Opportunities that came as a matter of course to children a generation ago do not come to many children now unless they are specifically planned for by some agency other than the home. Met wisely by the community, this seeming handicap may, in the end, result in a great and new found social strength.

10. Play is more than recreation. If its educational significance is real in the kindergarten period, it is real in every subsequent stage of growth and development. Rightly conceived, play is a most efficient method of education for life, for work, for social service. The fact that we do not yet know how to make full use of play in education need not and should not prevent the utilization of play, to the full extent to which we are prepared, for the tremendous social service it can render.

11. In the Cleveland school system, as in that of every large progressive city, there should be: —

a. An officer whose entire time should be devoted to giving a social interpretation to educational work, and an educational interpretation to social work. He should know the general fields of sociology and education, and should know intimately the fields of play and recreation. He should be to the social functions of the school what the director is to the business management, and what the superintendent of instruction is to the academic work. He should organize and utilize the physical properties of the school and, so far as practicable, the existing educational corps for the directing of the play and recreational interests of the pupils and the community towards constructive education and social progress.

b. An officer whose function is to organize and direct especially the active plays, games, sports, pastimes, and athletics of the system. He should have a general knowledge of the social and educational aspects of play and recreation and a technical knowledge of physical training. Cleveland has at present a supervisor of physical training having but limited authority in the elementary schools, and almost none in the high schools.

c. An officer whose function it is to supervise the play of young children to eight or nine years of age. She should have a thorough training in the fundamental principles of the kindergarten, plus the general social and educational background of a thorough knowledge of play and recreation. She should be a part of the division of physical education and not independent of it as she now is in Cleveland.

d. Besides the officers mentioned above, there should be one who is trained to organize and direct the almost universal, but greatly wasted or misused, dramatic interests; one who can utilize similarly the musical interests for educational and social progress; one the nature and nurturing interests; one the constructive; one the æsthetic.

These great lines of human interest and endeavor are replete with recreational as well as educational opportunity; they have their place as avocations quite as truly as vocations. The various official functions mentioned might, of course, be delegated to existing officers, and sometimes several might be combined in one person. But educational and recreational problems must be seen from each of these angles by some one who feels the burden of responsibility. Education needs play, and play needs education. The problem of adult recreation is but a phase of the problem of the play of children and youth.

QUESTIONS FOR STUDY AND DISCUSSION

1. How well worked out is the pedagogy of physical training and recreation? Where is more study needed? How far do the results actually gained in teaching justify the school superintendent in giving physical-training teachers more hours on the weekly program?
2. How may the value of a physical-training teacher's work be judged? What objective measures may be used?
3. Make a survey of recreational opportunities in your community. How widely are they used? Where they are not used, what is the reason? What might be a remedy?
4. Suppose that in a rough neighborhood when children are admitted to the playground they break windows, destroy apparatus, and gather at the playground at night for anti-social purposes. What should the school authorities do?
5. Do children from comfortable homes in suburban towns need playgrounds or "wider use" privileges?
6. How far may schools depend on volunteer help in conducting recreational activities?
7. In one community posture work for children with pronounced defects was prohibited on the ground that it was not fair to specialize by giving to small groups of children training which, because of its cost, could not be provided for all. How would you meet this argument?
8. Collect figures on physiological age, and present them in such a way as to show the distribution of each age among various grades in elementary and high schools.
9. What games are now being most used in classrooms? On playgrounds?

How far will these successfully compete with the popular activities of the street gang? What changes would you suggest?

10. What is the average "professional life" of the physical-training teacher? To what other occupations does it lead? How important is this question to leaders of the educational recreation movement?
11. Should teachers be expected to join in organized sports with their pupils?

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An exceedingly interesting survey report.

Johnson, George E. *Education Through Recreation.* Cleveland Education Survey Monograph. Russell Sage Foundation, New York. (1916.)

One of the most recent and comprehensive of the recreation surveys.

Knight, Howard R. *Play and Recreation in a Town of 6,000.* (A Recreation Survey of Ipswich, Massachusetts.) Department of Recreation, Russell Sage Foundation, New York. (1915.)

One of the earliest and best of recreation surveys.

Perry, Clarence A. *Wider Use of the School Plant.* New York, Survey Associates, Inc. (1910.)

Standard reference on subject.

The Playground — a recreation magazine. (1 Madison Avenue, New York City.)

Will furnish helpful suggestions.

Playground and Recreation Association of America, 1 Madison Avenue, New York City, issues material which is especially helpful in studying the question of school athletic leagues.

Department of Recreation, Russell Sage Foundation, 130 East 22d Street, New York, issues various publications on recreation, wider use, etc.

Boy Scouts of America. (200 Fifth Avenue, New York City.)

Camp-Fire Girls. (461 Fourth Avenue, New York City.)

Both of these organizations will be able to give considerable help in outlining recreational activities for school children.

CHAPTER XIII

EXCEPTIONAL CHILDREN

Two groups. As we have found in earlier chapters, the compulsory education law has had many and varied effects. When we insist that all children must attend school, we assume responsibility for sick children as well as healthy children; for the extraordinarily bright and the extraordinarily stupid. We herd together within the confines of the public schools children of all kinds and classes, and must therefore hold ourselves responsible for furnishing to them the sort of educational opportunity of which they can best take advantage. It is in recognition of this duty which falls upon the State that we are beginning to organize special classes for exceptional children.

Children who are irregular, who do not fit into the ordinary scheme of things, may be divided in general into two great classes: First, those who will be called upon to live the ordinary life of the ordinary citizen after leaving school; and second, those who will never be able to mingle with society at large, but will always be dependent upon others for support or guidance. These two classes are described by Dr. David Mitchell, in his monograph on *Schools and Classes for Exceptional Children*, under the headings "Socially Competent" and "Socially Incompetent." Under the title "Socially Competent" Dr. Mitchell would include such children as the blind, the deaf, the crippled, the anæmic, those suffering with speech defects, foreign children, and most of the incorrigible cases. All of these he holds, although badly handicapped at the start, may nevertheless be prepared to fit themselves for independent existence in the

community. On the other hand, there are certain children, such as the epileptic, feeble-minded, and insane, who are socially incompetent. When they reach the stage of adulthood, they will still remain a burden upon society.

Different educational treatment. If the distinction between these two classes be valid, it should be recognized in the type of education provided for the children while they are yet in school. Those who will be forced to mingle with the rest of the world on equal terms after reaching adult life should be given every opportunity for such association during childhood. Blind children, for example, should not be segregated in separate schools and institutions where they will meet none but the blind, and where special care will be given to them because of their infirmities. Rather they should be given every opportunity to associate with seeing children in a world of seeing people. Some special care they will need. They probably must have separate teachers, but just so far as their work can be carried on with seeing children to that extent will their school life resemble the real life into which they must shortly go. For all such children, then, special classes must be established, but these classes should be located in large public schools which normal children are also attending. Just as foreign children receive some of their best lessons in English by playing with English-speaking children, so also the blind, the deaf, and the crippled will receive valuable education at the hands of their more fortunate fellows.

The socially incompetent, on the other hand, will never associate on equal terms with normal people. The requirements of adult life for them are very different from those of normal people. Their school education must necessarily be different in type and material. To the lower types of feeble-minded children, for example, it is a foolish waste of time to give lessons in reading, writing, and arithmetic, to say

nothing of history and grammar, because they are absolutely incapable of taking advantage of the instruction. The insane, the feeble-minded, and the epileptic should be housed in buildings of their own where they will not be forced to associate with normal children, and where special education can be given them of the type from which they can most profit.

The socially competent. Most of the work for the blind, the semi-blind, and the deaf must necessarily be carried on in separate classrooms under special teachers and with special apparatus. They will only be able to take part in exercises with normal children in a few subjects. But they can, at least, be taught to play with normal children, and to feel at home when associating with them. The physically weak or actually crippled can associate with normal children to a much larger degree. Usually these children can take part in all but physical exercises, and while sometimes school hours must be shortened and home preparation curtailed entirely, nevertheless the work of the handicapped and the normal can be carried on side by side, so that each group will benefit from association with the other. Children who have defects of speech usually may remain in the regular classrooms with normal children, but should leave the class at frequent intervals during the week for special instruction by the speech teacher. Foreign children must often be kept in separate classes the first few weeks until they understand the rudiments of English. They can, however, join with the regular children in such exercises as singing, gymnastics, and the like, and as their ability to handle English increases, they should gradually be introduced to working with other children of their own age.

Incorrigible children present a more difficult and perplexing problem. Just as in outside life the modern tendency is to give a second chance to new offenders, to place them on

parole, etc., so with the incorrigible child it is probably wise to try the different forms of probation before actually placing the child in a special class. If, however, the child becomes so unruly that he interferes with the work of the classroom, he should be placed in a special class in the regular school building, and kept there until he can be returned to his proper room or else until he has proved himself so antisocial in nature that he has to be placed in a parental or truant school and separated from normal children.

The socially incompetent. No epileptic child should ever be allowed to belong to a class with normal children, nor should he be put in the unclassified special group with immigrant children, crippled, blind, and the like, as is sometimes carelessly done. If he must be in a group with other than epileptic, he probably belongs with the feeble-minded, but wherever possible should have a class by himself. Insane children are rarely found in the public schools. Usually they become so difficult to manage that they are early taken out and cared for at home or in private institutions. It is the feeble-minded who form the largest group of socially incompetent children among school classes. These feeble-minded range from borderland cases to profound idiots. It is almost impossible to make an exact estimate of the number which will be found in any system, because as a matter of fact authorities have not yet agreed as to what they shall call feeble-minded. Roughly speaking, about one third of all the children in the public school system are backward in their classes. Of these some are backward because of physical defects, some because of late entrance, some because of poor teaching, and some because of varying degrees and types of mental disability.

From the point of view of school administration, feeble-minded children may be divided roughly into three groups. In the first and highest group belong those children who are

dull and slow. They cannot keep up with the regular school work. They can be taught to do simple reading and writing, but will never read very much for pleasure. Most of the children in this group will be able to carry work up to about the fourth or fifth grade in difficulty. These children would not ordinarily be called feeble-minded by the layman. It is only the psychologist or the experienced teacher who realizes that they are sub-normal. Below them comes the second group of feeble-minded children, distinctly inferior to the first. These children may be taught to read and write, but such achievement is merely a trick. They can make practically no use of it. They do not know what the words they read actually mean, nor the purpose of what they are writing. These children can, however, under careful direction, be taught a simple trade in which little skill is required. They can usually do good manual-training work which does not require thinking, and can be kept happy and useful in a special class under a teacher trained for such work. The third group of feeble-minded children who are found in the public schools consists of those who are of such low-grade mentality that they cannot with any profit do even the simpler forms of school work. They can, with careful direction, be trained to take care of themselves, to fasten their clothing, to attend to their daily wants, to feed themselves, and to amuse themselves with simple toys.

In any large system the children of these three groups should be separated into different classes with different teachers. These teachers should have varying degrees of training. The teacher in the highest group needs to be skilled in the training of feeble-minded children. The teacher in the middle group needs considerably less training, and should naturally expect to receive a lower salary. For the third group a regularly trained teacher is probably not necessary, since any one who can keep the children happy

and lead them in simple amusements will answer the need successfully. It seems evident that the higher salaries and the better-trained teachers should be devoted to those classes of socially handicapped children which have been described in earlier paragraphs. It is for these children who are to be regularly independent members of society that the greatest care and the best teaching should be provided.

Assignment to classes. It is important if special classes for the socially competent and socially incompetent children be established in the public schools, that admission to these classes shall depend upon something more than the teacher's whim. The judgment of teachers as to the mentality of children has been repeatedly shown to be unreliable. Admission to the special classes should be handled by the director of school hygiene. In all cases, excepting probably the crippled and the anæmic, candidates should first undergo a thorough mental examination, given by an experienced psychologist who applies certain standardized mental tests, and determines the mental intelligence level of the child.

Such psychological examination should not be confined solely to children who are suspected of being feeble-minded. It will often be found true that children who are supposed to be deaf or blind are also feeble-minded, and therefore cannot profit from the instruction given in special classes for the blind or deaf. Speech defects are also frequently associated with mental deficiency, and the admission of feeble-minded children to speech-training classes should be carefully avoided. In a similar way candidates for the other special classes should undergo physical examinations by the doctor especially versed in the particular class of defects under consideration.

Not only should admission and discharge from special classes depend on the decision of the child hygiene department, but the work carried on in those classes should also

Courtesy, Elizabeth McCormick Memorial Fund of Chicago

FIG. 24. AN OPEN-AIR CLASS IN CHICAGO IN WINTER

FIG. 25. AN OPEN-AIR SCHOOL AT SAN DIEGO, CALIFORNIA
The Francis W. Parker School

be under the direct supervision of that department, so that matters of heating, ventilating, and physical condition of the children will be carefully kept under observation.

Open-air schools and fresh-air classes. Paralleling the movement in favor of special classes for exceptional children has come the open-air school movement. This was primarily established for tubercular or pre-tubercular children, and is gradually spreading to normal children as well. The open-air class is, as its name suggests, a class where children and teachers study outdoors in the open air rather than in a closed schoolroom. Many of these classes have been established on the roofs of buildings; others have been held outdoors under tents or on ferry-boats. Still others have been held in regular schoolrooms with windows completely removed from the frame, so that there is plenty of access to light and air.

The three essentials. There are three essentials for a successful open-air school. These are, fresh air, warm clothing, and good food. No one of these can be omitted without harmful results to the pupils. The clothing should consist of warm outer wraps, head coverings, and some method of keeping the feet warm. We all know that the most effective way to keep warm is to prevent draughts from chilling the body. This means that there should be no cracks or crevices in the clothing through which cold air can enter. Children should be provided with warm shoes and stockings. Sometimes heavy felt boots are found desirable. In addition they should be provided with sitting-out bags, which are made on the same principle as sleeping-bags, and are fastened to the chairs in such a way that the children's bodies, from the waist down, are thoroughly protected from draughts. In the so-called "cold-air" rooms, which are not officially designated as open-air classrooms, it is common to find the children provided with no means of keeping their feet

warm. Extra sweaters are usually the only wraps at hand. The danger of chilled feet is serious, and extra precaution should be taken against it. During comparatively warm weather it is also important to see to it that no child wears too heavy clothing. The teacher should be on the alert to detect signs of over-heating, such as flushed cheeks, damp hair, perspiration, and the like, and in such cases should require the children to remove part of their outer clothing. Over-heating is a frequent cause of colds.

It is essential that children in open-air classes should be provided with extra amounts of food. Food provides fuel for the body, and is rapidly turned into heat. If children are not given extra food, they are apt to become unduly chilled, and will not benefit by the open-air class work. It is also important that this food should be hot. Cold lunches, even though appetizing and nourishing, do not seem to be effective. Hot nourishing soup or cocoa made with milk may often be served to the children in addition to lunches they may bring from home. For children who are ill or anæmic it is especially important that large amounts of nourishing food be provided, under the direction of the school dietitian or physician.

Montclair's experiment. There are many conflicting reports as to the value of open-air classes. It has been demonstrated apparently that children who are convalescent or almost on the verge of tuberculosis, when placed in an open-air class with warm clothing and plentiful good food, will frequently gain in weight, become strong and well, and actually do as much or more class work than normal children of the same ages in corresponding grades. In other cases apparently careful experiment has seemed to show that open-air classes are no more valuable to children than the regular traditional class of the public school. In Montclair, for example, Superintendent Bliss reports on an experi-

ment with open-air classes in which extra feeding was supplied, and where each experimental class was accompanied by a control class in the same school, consisting of the same number of children, studying under normal conditions in the ordinary warm, well-ventilated schoolroom. His results are rather surprising.

He finds, for example, that children in the heated schoolroom gain more rapidly in weight than children in the open-air class. The number of absences from cold, sore throat, and contagious diseases were notably more in the open-air classes than in the regular classes. Moreover, carefully administered mental tests seem to show that there were practically no differences apparent either in the alertness of the children or in their ability to succeed in whichever class they had happened to join. According to the results of this study Dr. Bliss would feel that the value of the open-air class in Montclair is distinctly to be questioned. He suggests, however, that a possible explanation of the success in other cities is that in most cases the ventilating systems of schoolhouses are distinctly inferior to those in use in Montclair. He feels that, in Montclair, the experiment was one concerning the comparative value of cold fresh air *versus* warm fresh air. In other cities he thinks the experiment has been the comparative value of cold fresh air *versus* warm foul air. In the latter case, he suggests, it is probable that the open-air class would have distinctly beneficial effects upon the pupils. In finishing his report Dr. Bliss states that one of the interesting features of the experiment was that the parents were unanimously in favor of the open-air class work. They claimed that almost without exception their own children were greatly benefited by the plan. They asserted that children were less nervous, and ate and slept better than ever before.

The results of Dr. Bliss's experiment are not conclusive,

but they are highly suggestive. That open-air classes in most cases have proved beneficial to the children is a fact so clearly demonstrated that it cannot easily be shaken. Experiments such as that at Montclair do indicate, however, that we have yet to learn what it is about the usual open-air class which functions so effectively. Should success be attributed to low temperature, temperature changes, humidity, breezes, special feeding, sleep and rest periods, ungraded classes, picked teachers, or to a combination of these elements? It is strongly to be hoped that further classes will be carried on under experimental conditions, and definite scientific information secured.

QUESTIONS FOR STUDY AND DISCUSSION

1. Is it better to have one large open-air school for a community, or to have single open-air classes in several buildings? One building especially designed for feeble-minded children, or "backward" classes in each school? What should be done with incorrigible cases?
2. Can the schools properly be charged with caring for insane children? For feeble-minded? For epileptic? At what age should such dependents be placed in institutions? How long should they stay? Why may they not be left at large? What means of dealing with the problem other than segregation have been suggested?
3. If it is well for foreigners to associate as much as possible with English-speaking children, why is not the plan of placing them in primary grades and promoting them as they learn English better than placing them in regular classes for foreigners?
4. Suppose that you have in your school system separate classes for children who are deaf, blind, crippled, anæmic, defective in speech, incorrigible, foreign, retarded through absence, slow, borderland, moderately feeble-minded, low-grade feeble-minded, normal, and bright. Arrange these classes in order according to the professional preparation required of the teachers in charge, and the amount of salary you would be willing to pay.
5. Suppose you are in charge of a small school system where each type of mental, physical, or social handicap is represented by only one or two children, what arrangements would you make to care for them?
6. What are the commonest forms of mental tests? Into what general groups do they fall? What quality is each supposed to test?
7. If open-air classes are good for weak children, why would they not be

desirable for all children? If you were a school superintendent, what proportion of your rooms would you turn into open-air classrooms? Why? If funds are not available for extra feeding, is it better to have cold-air rooms without school feeding, or not to have any open-air rooms at all?

8. In the ordinary heated classroom where there is no other form of ventilation, do open windows in a warm climate furnish more or less frequent changes of air than in a cold climate?

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CHAPTER XIV

SCHOOL FEEDING

The argument for school feeding. The three meals a day to which the adult American has become accustomed are spaced at too long intervals one from the other for the comfort and health of most children. The growing child needs something to eat in the middle of the morning and in the middle of the afternoon, as well as at morning, noon, and night. Were he at home he probably would receive extra food at these periods, but when schools are in session, he must either eat a hasty lunch at recess or go without extra food during the several hours between breakfast and the noon meal. Moreover, many children are so situated that they cannot go home in the middle of the day for a hot meal. In some cases the schools are at too great a distance from the house, in others the parents are absent during the middle of the day and cannot prepare hot meals for their children. In all these cases three things may happen: the child may go without any food during the recess or noon period, he may bring a cold lunch from home, or he may purchase from neighboring stores and pushcarts.

Very few people realize the enormous amounts of money which are spent each year by school children for pickles, cakes, and candy, to eat during school recesses. In large cities the pushcart business makes literally thousands of dollars a year from this source alone, and in fact so important has the children's trade become that pushcart men and near-by store owners have actually secured injunctions against school authorities prohibiting the sale of candy or ice cream to school children, on the grounds that such sales

injure the natural trade of the food purveyors in the community.

It is because of the fact that children need food between meals, and that children are actually now provided with money and are buying the food from neighborhood dealers, that the organizers of the school-lunch movement have urged the necessity of providing such food, prepared under direct supervision of school authorities and sold at cost to the children. In cities where such service is not provided actual investigation has shown that children spend their money for a sausage and roll, pretzel, cinnamon bun, iced cakes, marshmallow cakes, hot corn rolls, candy eggs, licorice, chocolate peppermints, and candy rolls; whereas if given an opportunity they would gladly spend the same amount of money for such things as bean soup, rice pudding, cocoa, milk, royal lunch crackers, graham crackers, spice wafers, dates, milk chocolate, and stick candy. By actual experiment it has been found that purchases of the same degree of food value cost exactly twice as much on the average when made from the street vender as when made in the school lunchroom.

The Philadelphia experiment. In 1894 the Star Center Association of Philadelphia started a penny-lunch service at the James Forten School, Sixth and Lombard Streets. The School-Lunch Committee of the School and Home League was an outgrowth of the original School-Lunch Committee of Star Center, and the first of its kind in the United States. In October, 1907, the service of the Forten School was reorganized and service in two additional schools begun. In May, 1910, in order to have an organization elastic enough to meet the growing demand for school lunches, and which could readily be extended to all public schools, the School-Lunch Committee was organized as a standing committee of the Home and School League of Philadelphia.

In September, 1911, this School-Lunch Committee undertook a definite experiment in order to find out, first, whether or not children will buy wholesome food at school if given the opportunity, and what price they can pay for it; and second, to demonstrate a method of serving school lunches which would (*a*) maintain a definite standard of food and service at the lowest possible cost, and (*b*) become supporting to the extent of food costs, preparation, and service. The experiment was carried on for five years under the immediate direction of Dr. Alice C. Boughton, secretary of the committee. At the end of the five-year period a report was published by the School-Lunch Committee, giving its findings and recommending that the committee be discontinued as a private organization, and that the work be taken over and administered as part of the regular public school system. This is the most important experiment in school feeding of which we have as yet any record; and much of the material which is presented in this chapter is taken from or suggested by the Reports rendered by the Philadelphia School-Lunch Committee.

What school lunches are. In certain schools of Philadelphia the penny lunch was served during the morning recess. It consisted of: (1) one or two hot dishes, such as rice pudding, cocoa, creamed lima beans, macaroni with tomato sauce, bean soup, cream of tomato soup, succotash, cream of corn soup; (2) milk; (3) crackers, such as royal lunch, hard pretzels, ginger-snaps, graham, spice wafers, oatmeal crackers, and others; (4) jam sandwiches, made of royal lunch crackers and apple butter or jam; (5) fresh, dried, or stewed fruit; (6) clear sugar candy, peppermints, and sweet chocolate; (7) ice-cream sandwiches, cut six to a five-cent block. Each portion cost one cent and represented one hundred calories of fuel value. Children were urged to buy the hot dish or milk, but were not forced to do so.

At many of the special classes and open-air classes more elaborate meals were served. These varied, from the three-cent lunch, which consisted usually of a double-size portion of soup with bread and sometimes fruit, to full and elaborate meals. Children in the open-air classes, for example, were in some cases given breakfasts, recess lunch, dinner, and afternoon lunch by the school authorities, and care was taken to provide a plentiful supply of nourishing food at each of these meals. In many American cities the food for the open-air class costs about thirty cents a day per child, and represents approximately three thousand calories. It is, of course, true that where school lunches are already being provided for all children at cost, the expense of providing more ample meals at noon for special classes is very considerably reduced, because of the attendant saving in equipment and food materials which can be effected through the larger organization.

Theory of school feeding. There are two opposing theories of school-lunch service, both of which are now represented in existing practice in the United States. In the first place, it is claimed that the lunch service is a matter of charity. It provides food for those children who are too poor to secure proper nourishment at home. Where this point of view is held, it is not uncommon to find that the lunchroom is established and maintained through private auspices coöperating with the public school authorities. Money is raised from various sources, and expended for the more needy children. In a few instances the public school authorities themselves have established and conducted the lunch service, but still regard it as a matter of charity to be carried on in the poorer portions of the city. The other and newer theory is that the school lunch meets a real need of all growing children, regardless of their economic and social status. The child of the rich is as apt to be hungry in the

middle of the morning as the child of the poor, and is surely as much in need of wholesome food. Charity must often provide for the poorer children, but school lunches themselves are not primarily a charitable concern.

The concessionnaire. It is a very common practice in the United States to run school lunches on the so-called "concessionnaire" plan, whereby the school provides room, equipment, heat, and light, and gives the privilege of preparing and selling food to certain persons who carry on the school lunch as a profitable business. Sometimes the concessionnaire is a neighboring caterer or delicatessen owner. Frequently it is a woman of the community who takes this way of earning extra money. The concessionnaire is usually subjected to very slight supervision. Sometimes the work is very well done. All too frequently, however, the food purchased is of poor quality, it is badly cooked, and sold to the students at exorbitant prices. Naturally if the work is carried on as a business investment the concessionnaire plans to get as much money as he can for as little outlay as possible. The students, naturally, must often get the worst of the bargain. By far the better plan is to have regular saleswomen and their helpers hired directly under the direction of the superintendent of school lunches, and subject to careful supervision by her department.

The supervisor. The school-lunch organization should be part of the department of school hygiene, and the supervisor of lunches should be directly subordinate to the director of school hygiene. She should have the same standing as the medical inspector and psychologist, and should be herself a trained dietitian with considerable experience in the organization of school-lunch service.

The duties of the supervisor are many. They include, in the first place, the standardization of equipment and serving utensils. If the school lunch is to be spread over the entire

city, it must be, if not entirely at least very nearly, self-supporting. This means that the greatest care must be exercised to secure the best and most durable material at the lowest possible cost. Utensils must be simply designed, easily cleaned, and yet attractive in appearance.

In the second place, the supervisor must be responsible for the standardization of lunch service and of recipes. Under the old method each concessionnaire made her own recipes, purchased her own food, and displayed it any way she saw fit. The skillful supervisor of lunches attends to all these matters, so that not only will the food purchased be of standard quality, but it will be prepared according to standard methods, and be displayed to the children in such a way as to be appetizing and desirable. Much of the success of the school lunch depends upon the skill of the sales-person in awakening children's appetites.

In the third place, the supervisor must attend to the engaging and training of sales-people. This is an immensely important part of her work, since most of the good effect of the lunch can be entirely spoiled if careless, poorly trained, or uncleanly women are put in charge of the service in the individual schools.

Fourth, the supervisor must attend to the standardization of record blanks and account forms. This is particularly important in a large system. If the lunch is to be self-supporting, the most minute care is necessary in gathering and keeping records and in analyzing accounts. It is only by closest kind of calculation and planning that a deficit can be avoided at the end of the year.

Fifth, the supervisor must arrange for the extension of lunch service to new schools. She must plan all lunchrooms and order all equipment.

Sixth, she must be a person sufficiently well prepared to handle all publicity material, such as exhibits, reports, and

special articles, answer correspondence, and give talks in public on the subject of school feeding.

Saleswomen. A saleswoman is needed for each school where lunch is served. The qualifications for saleswomen vary according to the amount of work required from them. In schools where cooking is actually done on the premises, the woman must be a good practical cook, with some understanding of the simpler facts of dietetics. Much of the information necessary for good work can be acquired during service under careful supervision. Whether cooking is actually done on the premises or not, the saleswomen must be able to keep accurate accounts and to make friends with children. When saleswomen are only required for short periods during each day, excellent workers may frequently be found among the married women of the community who understand simple housework and are glad to earn a little extra money. The saleswoman prepares the hot dishes which are cooked at the school, keeps account of materials used, sends in requisitions for increased supplies, takes charge of the actual selling of the food to children, receives all money, and takes care of certain small bills from her petty cash account. It is well to have a plan whereby every saleswoman shall report once each week in person to the head of the school-lunch division. Where schools are very large, or heavy amounts of cooking must be done, saleswomen must often have under their direction one or more assistants, who should be appointed and paid by the central office.

Pupil workers. In some schools an effort is made to put the entire responsibility for school lunches upon the shoulders of the older girls who are taking courses in domestic science. It is claimed that this work makes domestic science a practical subject and gives the girls valuable experience. Undoubtedly there is much truth in this statement, but as a regular policy the scheme is open to severe criticism. Food

is to be served at low cost and yet the system is to be self-supporting. It is necessary to provide very simple menus which include comparatively few dishes, and those served over and over again. Where school children are used to prepare and serve the food, the tendency is to sacrifice the actual teaching of cooking in order to have the school lunch run on an economical basis. The girls cook the same things over and over, and after the first few days they fail to gain much valuable experience or information from their tasks. Domestic-science classes may occasionally assist with the school lunch with great benefit to themselves, but they should not be called upon to carry it throughout the year. In the same way, while it is often desirable to have a few children assist in serving and clearing up, it is not well to have the same children do this for long periods of time. The office of assistant should be regarded as an honor, and be awarded to new candidates at frequent intervals. It is usual where children serve as helpers to give them a free meal in exchange for their labors.

Centralization of the school lunch. One of the most important factors in making the school lunch self-supporting is to see to it that down to the smallest detail everything is planned out and nothing is left to chance. Where cities are willing to pay the extra cost it may be well to leave much to the initiative of the individual school or saleswoman; but where it is necessary to cut expenses down to the very lowest figure, the most careful planning and standardization is called for. This means, for example, that food for all the schools in the city shall be ordered from a central department, so that not only shall the quality of raw food be uniform, but that full advantage may be taken of the discount which is given on wholesale purchases.

In the same way all menus and the recipes followed should be prepared by the dietitian at the central office. This is

particularly important where not only must the element of cost be carefully calculated, but also the amount of food value in each penny portion. Long and careful study is necessary in order to be sure that the highest possible food value is being given to school children at the lowest possible cost. This work, by its very nature, cannot be undertaken by the less highly trained sales-person at the individual school. In working over the matter of food value the Philadelphia School-Lunch Committee found that the manufacturers of staple food articles are frequently not only willing but glad to have the opportunity to have their own food products analyzed by a food chemist, so that the schools may know the number of calories in each unit of their products. Manufacturers regard the school-lunch business as distinctly valuable, and are glad to go out of their way in order to assist the school dietitian in making such calculations.

In some systems cooking is done at each individual school. By far the most economical and efficient arrangement is to have central kitchens established in the high schools and centrally located elementary schools, in which cooked food for all the schools in the surrounding districts shall be prepared. The food is packed in heat-retaining receptacles, and is delivered to the individual schools either by messenger or by automobile. The plan of centralized cooking secures not only a saving in cost and preparation, but frequently insures a more palatable result, since higher-paid cooks may be employed in the central kitchen than would be possible where cooking is done at each of the separate schools.

Hygienic requirements. It is often suggested that school teachers should be required to undergo careful physical examination before they are allowed to enter upon their duties. Such a provision is even more desirable in the case of saleswomen who handle food sold to children. The exam-

ination of saleswomen, and the giving of free medical advice whenever necessary, should be a regular part of the medical inspector's duty. In the actual work of the lunchroom saleswomen and pupil assistants should be required to wash their hands before touching any food. Saleswomen should wear white aprons which entirely cover their regular garments, or else should have a working uniform which is used only while on service. Street garments of saleswomen should not be hung in the kitchen, but should be placed in special wardrobes provided for that purpose.

In serving food care should be taken that articles which are likely to catch dust, such as dates, figs, candy, and certain types of crackers, are carefully wrapped in oiled or waxed tissue paper so that dust cannot reach them. It is not necessary to place all food upon dishes. Some articles may be carefully piled on squares of paper placed on the counter. After all the food is arranged the entire counter should be covered with white cloths, and kept covered except when the food is actually being sold. Tables and counters should either be made with glass or white enameled tops so that they can be washed down every day with hot water, or they should be covered with strips of white oilcloth which are washed and removed to a safe place after the meal. Food is usually given out on the self-service plan; that is, it is piled on counters and children are allowed to pass single file before the counter and select what they want to eat. It is usually a good idea to have buckets filled with cold water placed near the exit to the lunchroom, and in this all children shall place their soiled dishes as they leave the room. This practice makes dishwashing much easier and prolongs the life of enamelware. In speaking of the question of school hygiene the Philadelphia Report reads as follows: —

The lunchrooms and adjacent halls should be swept with damp sawdust at least once a day; cement floors, when provided with

proper drains, should be washed at least once a week, and oftener in stormy weather. If cement floors are cold, damp, and hard, slat mats at counter, sink, and door should always be provided. They are easily kept clean.

The ventilation of basement lunchrooms is difficult, for generally they are not included in the ventilating system of the school. When windows are open in wet and windy weather, rain pours in, or else dust and dirt from the street. On this account it is better to close the windows during the lunch period and air the room before and between recesses, when the lunchroom counter is covered.

Records and forms. In a system where cost is an important feature it is essential that the most careful record-keeping system be installed. It is, however, very difficult for unprofessionally trained women, such as most of the saleswomen must necessarily be, to keep accounts accurately without special instructions. This is one of the reasons why it is so wise to insist that every saleswoman shall report at the office of the supervisor of the school lunches once a week. At this time she carries with her her weekly reports of money received, food given out, and the like, and has an opportunity to confer with the supervisor on the subject of account-keeping. Much of the most efficient supervision can be given during these office interviews. Watch can be kept upon the work of all the people without there being any feeling of spying or criticism. Principals of schools and saleswomen should be provided with loose-leaf notebooks of uniform size, and so far as possible all the report blanks should be of this same size so that they may be filed away together in one cupboard. The forms needed must vary with the individual system. The forms suggested by the Philadelphia School-Lunch Committee as desirable are the following: —

Form 1 — Time sheet. The time sheet has on it a space for every day in the month, with the words *arrived* and *left*, for each day. This sheet is kept in the office of the principal at the school, and

the saleswoman puts under the word *arrived* the hour at which she reaches the school, and under the word *left* the hour at which she is ready to go. Each month this sheet is countersigned by the principal and brought to the central office.

Form 2 — Cash capital account. This form is filled out by the individual saleswoman and balanced monthly. It shows the amount of petty cash on hand, cash received, cash expended, and balance at the end of the month.

Form 3 — Week order slip. Filled out by the individual saleswoman, telling the amount of goods on hand at the school, and an estimate of the goods which will be needed during the coming week.

Form 4 — Memoranda. Uniform slips giving date, school, and name of saleswoman, to be used for all memoranda, whether for orders for food, new or renewed equipment, changes in the recipes or service, or the like.

Form 5 — School recipes. Name of school, name of article, number planned to serve, ingredients needed, and directions for cooking.

Form 6 — School-luncheon account. A loose-leaf account sheet, kept by months for each school. Name of school, name of saleswoman, luncheon recipes by week, cost of food, and sundry cash expenditures.

Form 7 — Weekly menu sheet. Showing recipes prepared each day, materials used, number of portions made, and date sold. This form is turned into the office each week.

Form 8 — Salaries due. Order from the supervisor of school lunches, showing the amount of salaries due each of the saleswomen.

Form 9 — Order sheet. Giving address to which material shall be sent, and initials of person actually placing the order.

Form 10 — Table arrangement form. Blank showing table arrangement of different foods. The success in selling various foods depends upon the order in which they are arranged on the counter. Children are apt to take those things which are near the front and are apt to overlook those at the back, unless the ones farther away are familiar dishes which they have already tried. Saleswomen find it a distinct help to receive suggestions from headquarters as to the way in which food shall be arranged upon the counter, and the amount of each article which shall be served as a penny portion.

Form 11 — Transfer of food. Blank showing record of food material transferred from one school to another. It shows the date,

school from which food is taken, school to which it is delivered, name of food, amount, and cost.

Form 12 — Yearly summary. For individual schools, showing by months the number of different forms of lunches sold, receipts, cost of food, and salary charges, gain or loss.

Form 12a — Monthly summary. The same thing by months for all schools.

Form 13 — Yearly recapitulation sheet. Recapitulation sheet for all schools, showing by months total receipts, total sales of hot food, and per cent of hot food sold as compared with cold food.

Form 14 — Cracker list. List by individual schools, showing for each month the different kinds of crackers sold and the cost of each. Similar forms are kept for other kinds of food materials purchased at each school.

Form 15 — Equipment inventory. List of equipment at a given school. Duplicates of the list are kept at the different schools and at the central office.

Form 16 — Food inventory. List for each school showing food materials on hand when inventories are made, at the beginning and end of each year, and at intervals throughout the year.

Costs. The Philadelphia experiment worked out a rather careful system of cost-accounting. The main divisions in the administration of the Philadelphia lunch service were equipment, overhead charges, supervision, food preparation, and service. So far as practicable the committee divided costs under these groups for individual schools, as well as for the system as a whole. Under these groups this method of cost division showed: first, the cost of every part of the service at every school; second, furnished opportunity for comparing costs in the various schools; and third, gathered material for formulating working standards applicable to all schools. Probably no small part of the success of the committee in making the system self-supporting was due to this careful method of cost-accounting.

It is usually very hard to make any careful estimate of overhead charges for school lunches because, in general, lunchrooms are established in basement playrooms or un-

used classrooms, where the proper rental charge is difficult to ascertain. Rent, light, water, gas, and janitor service should be charged to the account of the school lunch, according to the amount it utilizes, but any such charge is at present very difficult to place.

1. Equipment. The Philadelphia Report shows that the initial cost of new school equipment is about ten cents per child. Such equipment lasts five years. It consists of cooking- and serving-utensils, the former of blocked tin, the latter the best grade of Swedish white enamel. The cost is kept down by having children served in relays and having dishes washed between serving, by buying equipment of durable quality, and by serving certain foods, such as crackers or fruit, without dishes. In 1912–13 the Philadelphia committee spent 2.46 cents per child for new and renewed equipment. The following year it spent 1.29 cents per child. Fixed equipment, such as gas range, sink, closet, cooking- and serving-tables, and benches are permanent, and no special fund need be set aside for their renewal. Excepting where the more expensive centralized kitchens are to be installed, the cost of equipping a lunchroom in an elementary school does not exceed one hundred and fifty dollars, and in many cases need not exceed one hundred dollars.

2. Supervision. According to the Philadelphia Report the cost of supervision varies with: (1) the degree to which the service is organized; (2) the type of service, whether individual or on the central kitchen plan; (3) the number of portions served; (4) the *per capita* expenditure; (5) the price per unit. In general, supervision in elementary schools is more costly than in high schools. In the elementary school the group served is generally smaller, has less money, and is affected by the seasons, weather, and outside attractions. Children spend their pennies for horns at Halloween, and tops and skipping-ropes during the first warm days of spring.

In Philadelphia high schools about one dollar out of every nine dollars is spent on supervision. In the elementary schools one dollar out of every six dollars. In 1913–14, in the elementary schools, the cost of supervision was about twenty-four one hundredths of a cent per penny portion. This charge included not only the actual supervision of the lunch system, but the original conception and organization of the system. The committee believed that after the system was organized and in full running order the charge could be greatly reduced. It held that in a system covering three hundred elementary schools, supervision for each portion served should not be more than three one hundredths or four one hundredths of a cent. This expenditure would insure for the children clean, wholesome lunches, served in a clean place, under conditions which would insure their getting right food standards.

3. Preparation and service. It was found in Philadelphia that the preparation and service cost varied inversely with the number of children served. In small schools it was sometimes as much as one and eight one hundredths cents per portion, while in large schools with large attendance and well-placed equipment it ran as low as twenty-six one hundredths of a cent per portion. It is believed that by careful planning and a system of central kitchens the cost of service would be very materially decreased. Each portion served was planned to represent one hundred calories of food value, and could usually be sold for three fourths of a cent when the cost of supervision and service was not included. Here again cost may be materially decreased by a system of buying at wholesale and in quantities for the entire system.

A very careful study must be made of school conditions if lunch sales are to be maintained at a high standard. It was found at Philadelphia that an average of sixty pennies was spent for every one hundred children in attendance

daily. The one factor affecting the sales was age. The younger children spent less than the older ones, excepting in the kindergarten, where children were given more money than the children in the first and second grades. The average expenditure per child per year was about $1.20. Lunch sales were largely affected by weather and season of the year, but did not parallel the curve of school attendance. During the winter months hot food was largely bought, regardless of the particular attendance during that time. The *à la carte* plan was more popular than *table d'hôte;* that is, the children preferred a choice of three-penny units to a three-cent combination. More lunches were sold at the ten o'clock recess than at any other time.

The children's taste varies not only with the different nationalities and localities, but at different ages and according to the weather and time of year. The colored children like their food very sweet; the Jewish, theirs very salty; some children will not eat rice pudding without raisins; others will not eat it with raisins. The menu for any school is a matter of nice adjustment among a conflicting set of "musts." The lunch must appeal to the children; it must average the standard amount; and it must be self-supporting. It takes time and thought to reconcile these differences to reach the point where children get their money's worth of food they like which measures up to the standard.

The Philadelphia Report. The Report of the Philadelphia School-Lunch Committee has been quoted at some length in this chapter, because the report itself was written expressly for the purpose of recording the results of a scientific experiment in education, and for furnishing to students of education the information which they need in order to understand what is involved in the establishment of a system of school lunches on a large scale. It is to be hoped that, from time to time, private organizations carrying on educational experiments will outline as clearly the problems to be solved, keep as careful and scientific a record of the

progress of the work, and when the conclusion is reached present the data secured in a form which may readily be utilized by school administrators throughout the country. The School-Lunch Committee of the Philadelphia Home and School League has made a real contribution to educational knowledge.

QUESTIONS FOR STUDY AND DISCUSSION

1. Is the school board justified in spending money for coal with which to warm children from the outside? Would it be justified in spending money for food with which to warm children from the inside? What if any difference exists between the social principles involved?
2. Local shopkeepers object to school lunches on the ground that they interfere with trade. How far is this claim a valid reason against school feeding?
3. How much choice should children have in deciding what they will eat? Should they be allowed to buy ice cream and nothing else? What about candy? Some children will eat mush if it is given free, but will not buy it. Is this an argument against including mush in free menus?
4. Should mothers be allowed to buy the school lunch and eat with their children? What arrangements should be made?

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INDEX